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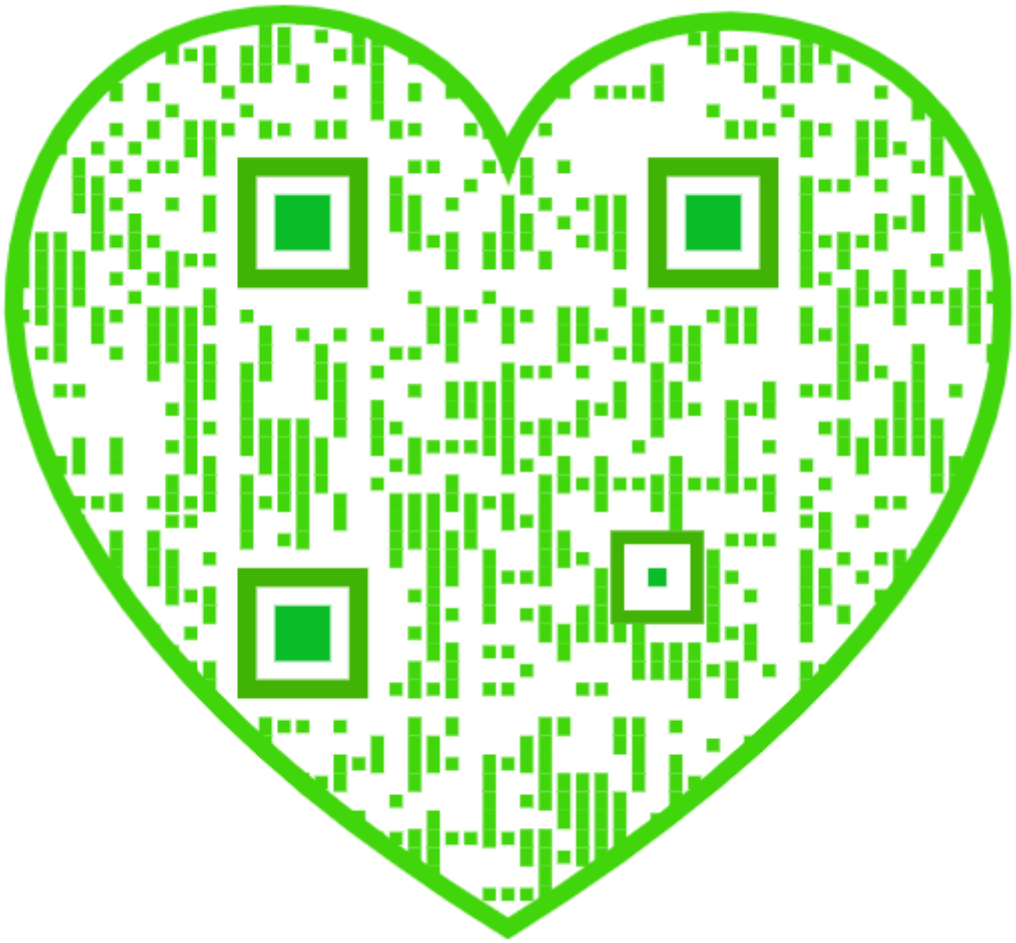

PROBLEMS IN FURNITURE MAKING

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FOREWORD

THIS book is presented to the public to assist those who are interested in the design and construction of simple furniture. It is planned, also, to be of assistance to instructors and students as a partial text, but more particularly as a class reference book.

Many of the problems have been worked by eighth grade pupils. It is believed that all are capable of solution by the average high school pupil after he has had one year's experience in bench woodwork.

The particular value of the revised over former editions of "Problems in Furniture Making" is in the rewritten and enlarged printed portion of the book together with what is believed to be a better selection of problems, both new and old.

While many of these problems are new, some are familiar because of their long use as school projects. These are included, with modifications, as it is difficult to replace them with better ones.

The author is indebted to his many friends who have offered helpful suggestions in the design and selection of problems. Those marked "F. D. C." are, in many cases, original only in the sense that the general proportions and dimensions are of the author's selection.

The users of this book will be materially assisted in interpreting the problems by the perspective drawings which were made by Edwin V. Lawrence, Pittsburg, Pa.

F. D. CRAWSHAW.

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DESIGN

Since writing the chapter on "Design" for the first issue of "Problems in Furniture Making," the author has given considerable additional attention to this subject. The chapter on "Form and Proportion" in "Problems in Wood-Turning" was the result of subsequent study and experience. While all the principles involved therein are not applicable to furniture design, it will be of great help if the user of this book will familiarize himself with them. At the close of this present chapter a chronological summary of steps taken in the design of a piece of furniture is given. The formal arrangement of these steps is the result, also, of the work of recent years.

In order that intelligent modifications of the completed designs herein presented may be made, and that initiative on the part of the pupil may be secured in the making of new designs, the following suggestions on design are given:

1. *General lines and proportions.* The general character of the lines will be largely dependent upon the lines in the pieces of furniture with which the one you are designing is to be associated; there should be a general harmony of line, a re-echo of line, in the room as well as in the single piece of furniture. The general proportions will be determined by the space your piece of furniture is to fill and its use. In case it has no particular place in the home or there is not a decided need for it, a design is not called for. It is believed that much of the furniture of either poor or mediocre design is the result of a misdirected effort due to a misconceived or purely mercenary demand.

2. *Construction.* The shape of the piece of furniture will generally determine its construction. One will hardly make a mistake in the selection of joints to be used, but there are many forms of some of the principle joints, such as the tenon-and-mortise joint, from which to select. Here, again, one must be governed by that fundamental law of design, viz., *there must be harmony.* If the general design is a severe one, then the protruding form of joint will be appropriate, such as, for example, the open or pinned tenon-and-mortise joint instead of the closed one or the screwed construction instead of the nailed butt-joint, etc.

Construction is no less an important factor in the ultimate beauty of a piece of furniture than is its design. The best-designed article may be ruined by poor construction. Makeshifts such as glued-on parts to represent protruding tenons and pins are deprecated. The butt-joint fastened by means of screws or lag

bolts may be an appropriate form of construction and serve as a means of decoration, but it should not be used as a general substitute for the tenon-and-mortise. It is a false interpretation of honest construction and is one of the many things in manual training which helps to swell the number of those who condemn the subject for its insufficiency and impractical methods.

3. *Decorative features.* Simple carving, upholstering or textile or leather paneling is often the thing needed to give a piece completeness in appearance, but, ordinarily, good lines, good proportions and good finish are quite sufficient to fulfil all esthetic requirements. The simple modeling of the top or bottom of a post and the introduction of broken or curved lines in some of the rails and stiles is sufficient decoration.

In addition to these three considerations, it is desired to call attention to two others dependent upon one or all of these three:

(a) There will constantly arise as one works over a design the question of widths and lengths of certain parts. Some of these will be *definite* because of the use to which the piece of furniture will be put, but many will be indefinite. These indefinite dimensions may be determined with some degree of accuracy if one will carefully consider the three following laws governing arrangement.

(1) Uniform spacing of similar parts is usually unsatisfactory.

(2) Wide masses and narrow openings should be made near the bottom of a piece instead of near the top to give the feeling of stability.

(3) The center of weight in a design should be directly below the center of gravity.

(b) The satisfactory filling of space areas is often difficult. This is largely a problem in decoration, although it may be one in construction when the strength of the piece of furniture is an important factor in the design. As an aid toward a satisfactory arrangement of parts in a given area the designer should become familiar with the term "measure" and the principles in design effecting it, viz., rhythm, balance and harmony, as set forth in E. A. Batchelder's book, "The Principles of Design."

The requirements of the individual problem must always serve as the basis for conclusions, but the three laws governing arrangement given above and the principle of re-echo or harmony of line will prove helpful guides.

For a more detailed consideration of the principles of design in connection with problems in furniture construction, reference is here made to an article by the author on "Furniture Design" in the April, 1906, number of the Manual Training Magazine; also to a series of articles by Prof. Chas. R. Richards on, "A College Course in Constructive Design," Manual Training Magazine, Vol. IX, Nos. 2 and 3. Attention is called also to the chapter on "Form and Proportion" in "Problems in Wood-Turning" by the author. Many of the prin-

ciples set forth in this chapter, especially those referring to mass divisions and combinations are applicable in the design of furniture.

Steps to Take in Designing a Piece of Furniture.

1. In response to a need for a piece of furniture consider carefully its detailed use.

2. Determine the material to be used in construction. In general, close-grained and fine-textured woods are most suitable for furniture which has a limited use such as parlor and bedroom pieces. The coarser-grained woods have their principle use in living and dining room furniture.

Again the close-grained and hard woods are best suited to pieces of furniture having many curved lines formed either by modeling or turning. The coarser-grained woods should be used principally in furniture of severe design.

3. Determine, if possible, the place the piece of furniture will occupy in a room. This will fix some of the definite dimensions and will enable one to make a wise selection of the kind of lines to be used that the piece may be harmoniously associated with its companion pieces.

4. "Block in" the design so as to make the piece of furniture harmonize with the general "make up" of the room. Secure harmony by having a re-echo of line.

5. Consider now the indefinite or detailed dimensions to make all parts of the piece members of one family. This will result in unity. All details such as the modeling of top and bottom rails, the use of curves in stiles and legs, the modeling of feet and top of legs or posts, and the making of metal fittings, etc., will affect this element—an all important one—in the design.

6. Make good construction and proportion serve as an important factor in the decoration of the piece.

7. Before considering the design complete, give careful attention to the three fundamental elements of design: viz.: rhythm, balance and harmony. If the several parts are so arranged and formed that there is movement as the eye passes from one part to another in the design, then rhythm has been secured.

If, by having the whole arranged symmetrically with respect to an axis or by a judicious arrangement of parts, the whole seems to stand or hang truly, there is balance.

If the design as a whole does not "jar" upon one; if all parts seem to belong together, then there is harmony. The design is a unit.

Correlation in Design.

It is believed that no better line of work can be introduced in conjunction with woodwork than that commonly called "Decorative Metal." Many woodwork constructions are enriched by the addition of some

escutcheon—a strap, a hinge, a pull or a corner plate. The making of these metal fittings may be considered a legitimate part of a course of study in woodwork, especially one in which emphasis is laid upon the design and construction of furniture. It is believed there is no line of work which offers a greater opportunity for the teaching of the principles of design and for their application than this. There is, too, not only an opportunity but a demand for close and natural correlation between furniture making and its associate, decorative metalwork.

The reader who would take advantage of the above suggestion to embellish his course in woodwork and to avoid the deadening influence of a long continued course of study in it (many of them now run from the fifth grade through the second or even the fourth year of high school) will do well to familiarize himself with "Copper Work" by Augustus Rose, and a series of articles by Arthur F. Payne on, "Metalwork with Inexpensive Equipment for the Grammar and High Schools," Manual Training Magazine, Nos. 4 and 5, Vol. XI, and Nos. 1, 2, 3, 4, and 5, Vol. XII, and Nos. 2 and 4,

CONSTRUCTION

It is taken for granted that the users of this book have had some instruction in the use of tools. It is hoped that classes in manual training will undertake to construct but few of the projects herein suggested until they have had at least the equivalent of the average bench woodwork of one school year. It is not proposed, therefore, in this chapter, to dictate in detail any method of using tools, but to give in the few following pages some specific suggestions for the cutting of certain joints and the method of working up stock for certain classes of work, in the hope that they may be helpful.

It is believed that the working drawings in this book show the method of construction, as a rule. It is supposed that the best method of construction is desired in any piece of furniture and the author has given what he believes to be the best appropriate method in each individual case. It will be found that the butt-joint is used in all pieces where lag screws, blue-headed screws or wooden pins are called for. Such pieces should be measured and squared for length by holding them together by means of a clamp during this process. The fact that the butt-joint is herein mentioned does not mean that it is recommended. It is supposed that in planing stock the workman will establish a joint edge and face edge from which all squaring will be done.

Assuming that one year of bench woodwork has been done by most pupils who will undertake any but the simpler problems in this book it is to be supposed that woodworking machinery will be used to get out stock. Except for enough hand planing to take off machine marks, the planer and the circular saw may be used to prepare most pieces of a project ready to be put together. This refers both to cutting to length, width and thickness and to cutting joints. The following suggestions are given, therefore, for the order of work on machines.

Steps to be Taken on Machines.

1. Select boards from the stock pile so that their length and width will permit of the greatest economy in the cutting of lumber.

2. With a hand crosscut-saw, cut boards to approximate lengths. (It is assumed that a bill of stock will be made out before this is done.)

3. On a surface planer, or better on an edger, dress one side and one edge of each piece for face and joint edge.

4. With joint edge against rip-saw guide, saw lumber to approximate widths. Of course all boards of a certain width will be ripped before the guide is reset.

5. With face side against the bed of a circular planer, plane all stock to approximate thickness. All lumber of similar thickness will be planed before re-setting the planer.

All stock should now be taken to the bench and dressed to the finished dimensions with hand planes. Ends of boards, except where they will show in the finished project, need not be finished by hand.

The Cabinet-Maker's Method of Getting Out Stock.

Where a number of pieces of wood are gotten out for one piece of furniture it is wise to be very systematic in the method of laying out and sawing up these pieces. The following method is suggested as good: From a complete working drawing of the piece of furniture to be made, make an itemized list of all pieces of wood, putting those together in the list that have equal widths and lengths, and making note of different thicknesses if there are any.

The cabinet-maker's method of working consists in doing all similar operations on all pieces while tools and machines are set. If this happens to be the cutting of tenons or the boring of mortises, be careful to complete this work on all pieces before beginning some other operation. Just what should be done first and what second, and so on, it is difficult to say, but it is always safe to complete all ripping and crosscutting in getting stock to the roughing dimensions before any hand dressing is done. It is likewise well to have all pieces dressed and finished to the dimensions given on the drawing before any joints are laid out and cut.

One further point to note in the economy of labor is to keep pieces which are to be glued together to form doors, sides of cabinets, etc., glued up and clamped as the work progresses so that when all tool work is done the several parts of the piece of furniture are glued up and ready for the final assembling.

A word about scraping and sandpapering may not be out of place here. The best suggestion one can give in this connection is to do this part of the work thoroughly. Whether each piece should be scraped and sandpapered before any gluing is done or not is an open question. Much time may often be saved by postponing most of this work until the piece of furniture is assembled.

The Tenon-and-Mortise Joint.

The "T-and-M" joint, as the tenon-and-mortise joint is briefly designated, is the principal one used in furniture construction. The one ordinarily used is the closed T-and-M joint, or the one in which the tenon goes only part way into the mortised piece. Usually

in furniture the tenon is held in place by glue, and if the joint is made well the glue will be sufficient to keep the joint tight for many years. It is true that in some factory furniture these joints often loosen in a short time but it is due to careless workmanship rather than to the kind of joint.

Laying Out the Tenon-and-Mortise Joint.

For the benefit of those who may not be familiar with the process of laying out the tenon-and-mortise joint the following method is suggested. After all the pieces are planed to the proper width and thickness and the face sides and joint edges marked, put together in vise, with joint edges up, the tenon pieces that are to be cut the same length. From the center of one of these pieces (preferably the one nearest the workman) measure each way one-half the distance between the shoulders of tenons (it is supposed here that a tenon is to be cut on each end) and make a point with the end of a knife blade. With a try-square or carpenter's square and knife, square a line through these points across the joint edges. Now take the pieces out of the vise and square around each end from the line already marked on joint edge, being careful to have the beam of the square always on either face side or joint edge. To measure thickness of tenon lay rule on joint edge of one board and mark points with end of knife blade for tenon thickness. Take the marking gage and set its stop so that the marker touches one of these points when the stop is firmly pressed against the face side. Before resetting gage, mark all pieces for this width. Now, set marking gage for the other point, again having gage stop against face side, and proceed as before. If the workman has access to a power saw, all the work of cutting the tenons may be done on it, but it is believed that quite as accurate work may be done with hand saws. Any trimming may be done with chisel and plane after sawing has been completed.

The mortise is laid out and constructed by a similar method when the mortise stock is thicker than the tenon stock. In laying out mortises for "flush" T-and-M joints, gaging the respective sides of the mortise should be done simultaneously with the gaging of corresponding sides of tenons.

A Second Method of Laying Out the Tenon-and-Mortise Joint.

The importance of the tenon-and-mortise joint in furniture construction is so great that a second standard method of laying it out and cutting it is here suggested. Proceed as in the first method to the point of measuring from the center of stock each way to tenon shoulder points. Instead of taking this step measure each way

one-half the full length of stock including the length of tenons. As in the first method square across all pieces while they are fastened together in a vise or clamp.

Each piece may now be placed against a double-end crosscut saw guide and by sawing *to* these squared lines and *in* the waste stock all pieces will be sawed to the same length. Now by using the single-end cross-cut guide and the rip-guide together, and by having the rip-guide set away from the saw the length of the tenon and through the saw table the thickness of the tenon shoulder, all tenons may be cut without laying out the tenon shoulder lines as in the first method. With a good saw and with accurately cut stock this method rather than the first one is to be preferred.

The mortise is laid out and cut as in the first method except that in "flush" construction as well as in "off-set" construction mortise thicknesses will be gaged independent of the tenons. The cabinet-makers' method should be used, however. A "mortise" gage may be used, also, thus saving the necessity of resetting a regular marking gage to determine the position of the second surface of mortises.

The Panel.

In most cabinet work, to avoid winding, warping, etc., wide spaces are filled with a frame, the corners of which have a T-and-M joint. The center of this frame is a single board or a series of boards separated one from the other by boards known as "stiles" and "rails." These are usually flush with the frame and on their panel edges have "rabbets" or grooves for the insertion of the panel edges. Three kinds of panels are used: (1) the panel flush with its frame on both sides, (2) the panel flush with its frame on one side and inset on the other, (3) the panel inset in its frame on both sides. The first is used where strength alone is desired, the second where strength and appearance are both necessary. In this case the inset comes on the outside of the piece of furniture. The third also is used where appearance, as well as strength, is essential. If a power saw is used for cutting this joint, the face sides and joint edges should always be placed against the saw guides. The work of gaging may be omitted, although, for the beginner it is recommended.

FINISHES

The aim in finishing wood is two-fold: (1) To preserve the wood: (2) to produce an agreeable surface, color and texture.

The old method of filling and varnishing a piece of furniture is still practical, but since the advent of the so-called craft furniture there has been a desire to produce an even-toned color, and staining has seemed to be the most practical method of doing this. One can purchase on the market innumerable prepared stains of which there are three general divisions, viz.: water, oil and spirit. In general it may be said that while a spirit stain penetrates the wood better than either of the first two mentioned it is often difficult to apply. Oil stains do not offer this objection but are sometimes unsatisfactory because they rub off easily. They should, therefore, be covered with some preservative which is also a fixative. Usually, the firm manufacturing a stain also makes a finishing material to apply after the stain is used. If this is not the case. a *very* thin shellac will serve both to preserve the stain and to fix it. Water stains should also be covered with some gum preparation, but in no case, unless a high polish is desired, should this material be thick. It should be thin enough to penetrate the wood almost immediately after application.

It is impossible to give a list of all the good stains now manufactured. Probably no two people would select the same ones for a recommended list. Consequently the names of the firms, familiar to the author, manufacturing stains good in quality both as to tone of color and durability are given rather than a list of stains. In any case, whether one is to use a manufactured stain or one made in the school shop, the greatest care must be taken to remove all glue, and to scrape and sandpaper thoroughly before staining. Also, to experiment with the particular stain to be used on the exact kind of wood which was put into the project to be stained before the final work of staining begins is imperative if the best results are to be secured.

Chicago Wood Finishing Co., Chicago, Ill.

Chicago Varnish Co., Chicago, Ill.

The Bridgeport Wood Finishing Co., Bridgeport, Conn.

Blood & Co. St. Paul, Minn.

The Adams & Elting Co., Chicago, Ill.

The S. C. Johnson Co., Racine, Wis.

The Sherwin Williams Co., Cleveland, Ohio.

It should be said that no pretense is made here to list all firms which manufacture stains satisfactory for manual training use.

The great objection to any of these prepared finishes is their expense. Below are given several methods of finishing wood which some experimental and practical experience has demonstrated to be good. In most cases they are comparatively inexpensive. Some of these are old but some are probably new. In giving them let it be understood that good results will be obtained only when the directions are explicitly followed; even then in some cases it may not be possible to get results that are uniform. The same stain on different pieces of the same variety of wood may give slightly different effects.

Oil Finish.

Perhaps one of the oldest methods of finishing wood and one used today for some work is to fill the grain with two or three coats of boiling-hot linseed oil, allowing about twenty-four hours to elapse between applying the coats. The oil serves as a preservative and at the same time, when rubbed often, it will give a dull finish. The surface oil evaporates soon, however, so that one cannot rely upon oil alone to keep a polish. This method of finishing wood is especially good for porch and yard furniture. Care should be taken not to put on enough oil at one time to allow a film to form on the surface of the wood when the oil dries.

Wax Finish.

The old method of finishing furniture by rubbing it with beeswax is still followed. During recent years it has become very popular. Prepared wax is fairly satisfactory but a wax may be made by cutting up beeswax and mixing it with about one-third its bulk of turpentine and heating the two together to the boiling point. This should be done in a double boiler, The preparation may be allowed to cool, after which it should be rubbed on and then off with considerable pressure. A more satisfactory method is to apply the wax hot and rub with a soft cloth as it cools. To produce a fine lasting polish three or four coats should be applied, allowing from one to four weeks between applications. A soft cloth should be used in dusting a piece of furniture finished by this process. Better results may be obtained by allowing each coat of wax to harden during several hours before rubbing it.

Fuming.

A darkened color may be produced artificially on wood by placing it in a tight box and then setting in the box an open dish of concentrated ammonia. The woods most affected by the ammonia fumes are oak, principally quartered oak, and chestnut. The depth of color increases with the time of exposure. A preparation known as "Fumine," manufactured by Walter

K. Schmidt & Co., of Grand Rapids, Mich., will deepen the color if applied on the wood before it is placed in the fuming box. Tannic acid may be used in place of Fumine by dissolving the flakes in alcohol and applying the liquid with a brush. Fumed work should be finished by the wax finish process. The fuming should be done after the piece is sandpapered ready for finishing.

Filling and Varnishing.

For many years one of the most popular methods of finishing furniture was that of filling the grain of the wood with some paste, which might be colored to suit the taste, and which would harden, and then covering the entire piece with some fixative preparation such as varnish or shellac. There is probably no method of finishing furniture today that preserves the wood better than this one. After the article to be finished has been thoroughly scraped and sandpapered apply some good paste filler, thinned to the consistency of thick cream, with boiled linseed oil and turpentine. Put it on with a brush or piece of cloth and allow it to stand about five minutes until it begins to dry. When this drying begins, rub the filler off with a piece of burlap or a handful of shavings. Rub across the grain. After ten or twelve hours apply a coat of hard oil or varnish with a soft brush and let this thoroughly harden. The time required for hardening depends upon two conditions: the character of the varnish and the temperature of the atmosphere. Usually not less than twenty-four hours should elapse between applications of the finishing material in a room kept free from dust and having a temperature of at least 72° F. Varnish should be applied with a high grade soft bristle or camel's-hair brush. The brush should be passed over the surface of stock by long uniform strokes and it should be kept well filled. When hard, rub the varnish down with fine sandpaper to smooth the surface. Repeat the varnishing and sandpapering process three or four times until a perfect surface is produced; then apply another coat of varnish thinned more than the former ones and, when hard, rub down with pumice stone and rubbing oil. To give life to the finish continue rubbing with rotten stone and water, applied with a piece of burlap drawn over a piece of sheet cork, or with a piece of harness-maker's felt. A coat of wax put on after the rotten stone is used will add to the appearance of the finish.

Staining, Filling and Varnishing.

The filling and varnishing method of finishing furniture produces a striking grain with open-grained woods. If it is desired to fill the grain to produce a smooth surface and yet not show a strong grain, the wood should be stained before the filler is applied. A stain of almost any desired color may be obtained by mixing dry colors ground in oil with boiled linseed

oil to make a paste and then thinning with turpentine. Stains made in this way are likely to cloud and obscure the grain of the wood. They should be applied in thin coats, two or three being used in preference to one heavy coat. The colors recommended are: Drop Black, Lamp Black, Burned Umber, Raw Umber, Vandyke Brown, Yellow Ochre, Prussian Blue, Paris Green and Venetian Red.

A stained, filled and varnished piece of furniture should be prepared as follows:

Order of procedure: Scrape. Sandpaper. Dust. Wet down with water. Let dry. Sandpaper. Dust. Stain. Let dry. Wipe with soft cloth. Fill. Let dry. Wipe with soft cloth. Varnish as described under, "Filling and Varnishing."

Analine Dye Stains.

The analine dyes, dissolved in alcohol, usually make satisfactory stains, also. Some of them, however, will fade in time. Seal Brown has proven the most satisfactory in the author's experience. After the piece of furniture has been thoroughly scraped and sandpapered is should be covered with water to raise the grain in order that the stain will not do this when it is put on. After the wood drys rub down with sandpaper and apply stain with cloth. When the stain is dry the piece may be filled and varnished as described under the head of "Filling and Varnishing." To this may be added a coat of wax, or the wax finish may be used alone.

Log Wood Stain.

A rich purplish black will be produced on oak or chestnut by covering the wood with a solution of logwood prepared as follows: Boil logwood gum, as it is sold by druggists, in water until a deep black liquid is obtained. About four or five pieces of the gum as large as a walnut, boiled in a gallon of water, will give about the right color. While the mixture is still boiling hot add about half a tumbler of washing soda and stir until it is dissolved. When the solution is cold apply with cloth until desired color is obtained. Finish with wax, shellac or varnish.

Japalac.

A very desirable black may be obtained on almost any wood by thinning Dead Black Japalac with turpentine and applying as a stain, rubbing off rapidly as it is applied. This stain does not need to be covered with a preservative. Other colors of Japalac may be prepared for stains of corresponding color.

Old Dutch Stain.

This is not the prepared finish sold under the same name but a home-made mixture which gives to oak the appearance of great age similar to the old pieces of furniture of German make so much admired. Mix two parts of drop black to one of lamp black with

turpentine until a liquid that will just flow is obtained. Add to this enough burnt umber to kill the "dirty" black. A very little of the umber will do this. Apply to oak or chestnut after wood has been wet with water and rubbed down with sandpaper. Rub the stain in and off evenly. When dry, cover with a very thin coat of shellac to fix stain, and finish with wax.

Bichromate of Potash Stain.

This method of finishing wood is spoken of a number of times in this book because it has been successfully handled by the author and is an easy stain to apply. It gives a brick-brown color and when rubbed with an oiled cloth will keep a dull lustre for a long time. Make a concentrated solution of powdered bichromate of potash using hot water. Soft water is preferred. Prepare wood (oak and chestnut take this stain better than most other woods) as before described and apply stain with cloth. Let the stained piece stand over night. The yellowish-brown crystalline surface which will be found in the morning will turn to a brick-brown color when rubbed with linseed oil. No finish is necessary over this stain.

Asphaltum Varnish Stain.

A rich chocolate brown may be produced on almost any open-grained or light-colored wood by thinning asphaltum varnish with turpentine and applying with a cloth, rubbing rapidly to avoid sticking. If the asphaltum varnish is made very thin it may be applied with a brush and allowed to harden as any varnish will. Unless the varnish is put on rather thick a covering coat of shellac or finishing varnish should be added.

Acetate of Iron Stain.

A stain that is easily made and applied with very good results on butternut and chestnut is one which may be made by soaking iron filings in vinegar. The filings or chips should be from cast iron. Soak them in vinegar, stirring occasionally, for a week. Apply in the same manner as other stains. Butternut stained with the acetate of iron and rubbed with an oiled cloth will turn very dark—almost black. Chestnut will be made a soft yellowish brown. A wax covering will give life and durability to this stain. Chestnut, finished with this stain and afterward fumed, will turn a deeper brown with the characteristic velvet appearance that fuming always gives.

Iron Sulphate Stain.

To give a grey stain to oak, boil it in a solution of iron sulphate made by dissolving one ounce of chemically pure sulphate of iron crystals for each pound of wood in enough water to entirely cover the wood. Separate the strips of wood with pieces of glass and weight the wood down to insure its being kept under water.

About one dram of sulphuric acid should be added to every gallon of the solution to keep the iron in the form of a sulphate. When dry rub thoroughly with a dry cloth.

Silver Nitrate Stain.

A weak solution of silver nitrate on chestnut which is afterwards fumed with ammonia will give a dark brown. Wax makes a good finish for this stain.

Dry Color Stains.

After experimenting for a number of years with wood finishes in manual training woodworking classes, the author has come to the conclusion that, aside from the few finishes herein described and some of the stains to be found on the market, one can get about as satisfactory results, as in any other way, by mixing the dry colors (obtainable at painter's supply houses) with boiled linseed oil and turpentine. A little experimenting will determine the colors and the quantity of each, to mix together to produce a desired shade. Those which will be most used are listed under, "Staining, Filling and Varnishing." After the mixture of dry colors is made, add enough boiled linseed oil to make a paste and thin this with turpentine. Apply stain with cloth and finish with varnish or shellac. Rub the fixative preparation down as described under, "Filling and Varnishing."

Other stains and finishes might be suggested here, but it is the purpose of this chapter to make mention of those only which are known to be among the best. The reader is referred to the following articles and books for further material on this subject. In giving this direction it may be well to offer the following injunction:

To procure the most satisfactory results in the staining and finishing of woods, one must become a patient experimenter. No stain or finish should be used, no matter how highly recommended or with what success previously used, until it is tried upon samples of the same wood upon which it is proposed to place it. These should be selected and prepared for the stain with as much care as would be used in the process of finishing any piece of furniture.

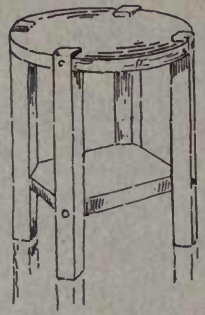
References on Wood Finishes.

Chapter on Finishes in Noyes' "Handwork in Wood."

Article by C. S. Van Deusen, Manual Training Magazine, No. 2, Vol. VI.

Handbook published by Berry Bros. the varnish makers.

Handbook published by S. C. Johnson Co., Racine, Wis.



NOTES ON PROBLEMS

1—Taboret

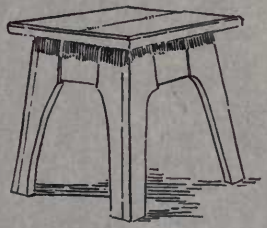
A seventh or eighth grade problem. This is a very simple yet attractive piece of furniture, and may be made by any boy who has had a little experience with tools. The design may be varied without injury by widening the legs somewhat and using thinner lumber for them. The author believes that round-headed blued screws will make it a stronger piece of furniture than will wooden pins. In order to guard against splintering where the recesses are cut for the legs a hard wood or a close-grained soft wood should be used. If made of hard wood, maple will prove to be a good one, although oak may be used. If oak is used fume and finish with wax. If butternut is used and a dark finish is wanted, use the acetate of iron.

2—Taboret.

A seventh or eighth grade problem. This is the simplest form of taboret involving the tenon-and-mortise joint. It is appropriate from the standpoint of utility, and when well proportioned is good in design. To secure the necessary element of strength, the rails should be made but very little, if any, less than four inches in width. This piece may be made of almost any wood. Carefully selected pine stained brown will make a serviceable and beautiful taboret in this design. Chestnut may be used with good results. Oak, fumed or stained and fixed with some preservative such as thin shellac or underlac and then waxed, will give the best appearance.

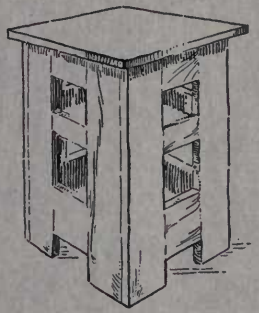
3—Shoe Polishing Box

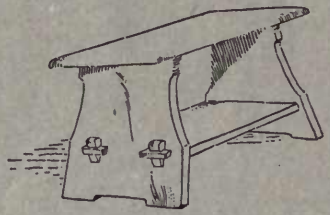
An eighth grade problem preferably, although it may be made well by some seventh grade pupils. The rail should be kept as wide as shown in the working drawing of this project to secure strength. The construction involves the use of the bevel-square and some, although not difficult, angle construction, unless the corner boards are fastened together by some joint other than the butt as shown. One half of the top should be fastened with nails or screws from the top to the rails. The other half should have a foot-form modeled from wood, or one which may be secured at a hardware store, fastened on the under side. Hard or soft pine finished dark will be an appropriate material. A "Dry Color Stain" is recommended. One coat of varnish or shellac rubbed down and then waxed will give a suitable finish for this utility piece.



4—Taboret

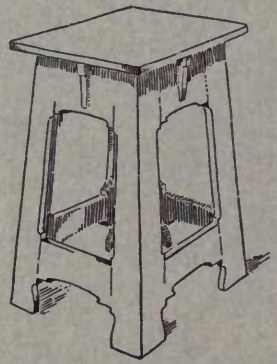
An eighth grade or high school problem. This piece will prove attractive in a living room or on a porch. It is designed to acquaint the maker with the problem of laying out and cutting tenon-and-mortise joints by the cabinet maker's method. If it is undertaken by a high school pupil the joints may well be cut on machines. The placing of the rails offers a good problem in breaking up an area into well related parts. Some open-grained wood or one having distinguishing marks such as cypress will be most in keeping with the design. If the piece is to be used on a porch it should receive the oil or asphaltum varnish finish.





5—Bench Stool

An eighth grade or high school problem. This project introduces angle tenon-and-mortise and angle housing construction. It should be made of some wood which will not break or splinter easily. An open-grained soft wood such as chestnut will not prove satisfactory. Either poplar, maple or birch, if oak is not preferred, will make a strong piece of furniture in this design. Finish any one of these woods with bichromate of potash and rub down with oil. A coat of wax may be added after the oil has evaporated.

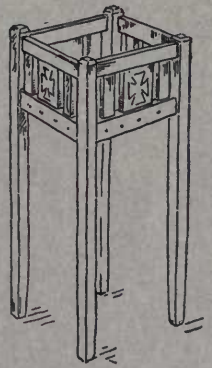


6—Pedestal

A high school problem. This project is not particularly difficult in construction. The rails may be tenoned or halved into the legs. The joints are square cut and may be made without difficulty, therefore, either by hand or on machines. This piece will be attractive either in a library or club room, and may be used for a large plant, a piece of statuary or as a stand for a smoking set. Its companion pieces will call for chestnut, ash or oak in its construction. A brown or green stain finish, covered with some preservative to give a dead finish, is suggested.

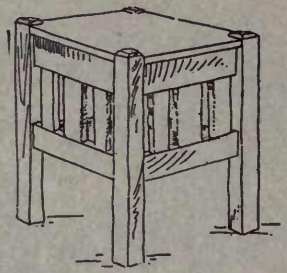
7—Plant Stand

An eighth grade or high school problem. This may be made of pine, poplar, or, if open-grained wood is desired, chestnut or oak. The piece is suitable for porch or inside of house. The decoration on middle slat is suggestive only. Simple veining or relief carving may be used, or the more difficult problem of inlaying may be introduced.



8—Taboret

A high school problem. This is a difficult piece to construct and should be undertaken only by one who is somewhat experienced in woodworking. It should be laid out with the greatest care and constructed so that all joints will fit very closely. Pine, poplar or gum is recommended. Some light stain covered with a dead varnish finish will be attractive. A natural finish in oil, wax or some prepared quick-drying varnish will require less effort and skill.

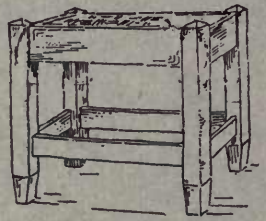


9—Taboret

An eighth grade problem. Pine with a strong grain, if finished with asphaltum varnish thinned with turpentine and rubbed on the wood while fresh, will make this an attractive and serviceable piece of porch furniture. It is also suitable for inside use. A dark green stain on poplar will make of this a beautiful library or study jardiniere stand. A dead varnish known as "Deadlac" is very appropriate over the dark green color.

10—Woven Top Stool

An eighth grade problem. This may be used as a low seat or a foot stool. Make stool of some close-grained soft wood or of oak. In the construction, cut the tenon-and-mortise joints before tapering the legs. Wind flat pith cane over and around opposite rails. When finishing, stain the entire piece with some good prepared stain such as Ad-el-ite, a preparation that does not need a covering of varnish. If oak is used a soft greyish-brown tone may be obtained by fuming the entire stool.

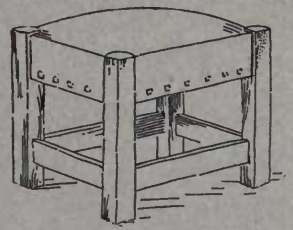


11—Woven Top Stool

An eighth grade problem. Pine or chestnut will be suitable if this project is undertaken by grade pupils. Oak may be used by high school pupils or those capable of working in hard wood. The problem of framing is a good one here and the weaving of the flat pith cane offers a chance to use some originality in the pattern design. Care must be taken not to get the material used for the weaving too tight at first or the last strands will be very difficult to weave through. A long needle made of thin band iron is suitable for the weaving. The edges of the frame should be rounded slightly to prevent the cane from breaking.

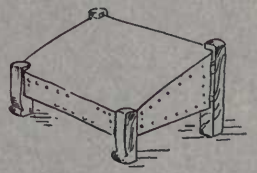
12—Leather Top Stool

An eighth grade problem in ordinary framing and upholstering. For the eighth grade pupil chestnut makes a very satisfactory substitute for oak and is much more easily worked than oak. A rich dull brown will be obtained by finishing with a turpentine preparation of raw umber, first made into a thin paste with boiled linseed oil. After this is well rubbed into the wood apply a coat of very thin shellac. This need not be rubbed down if it is sufficiently thin. Its purpose is to "fix" or "set" the stain. It is not used in this case as a finish. Wax should be used for this purpose.



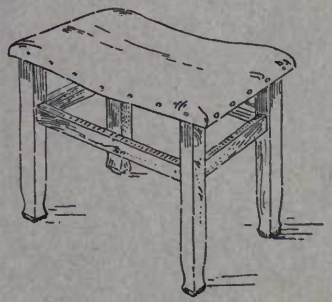
13—Foot Stool

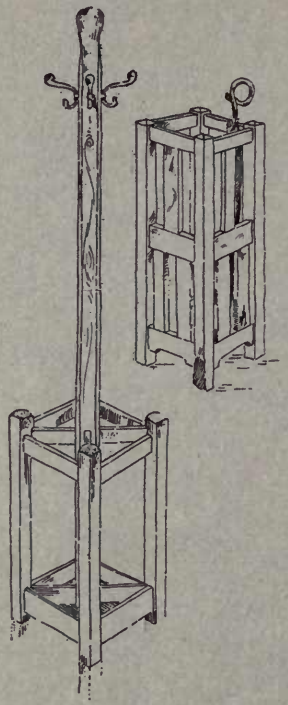
An eighth grade problem. This is a simple problem in tenon-and-mortise framing. Oak or hard pine is recommended as a good wood for this project. If chestnut is used the front corner posts should not be severely modeled. The upholstering may be done with leather or its substitute, pantasote. This and other leather substitutes may be obtained in almost any color, particularly in the browns and greens. The first cost of these is less than that of leather but for quality and durability the latter material is unquestionably the best.



14—Leather Top Stool

An eighth grade problem. Model top out of a two-inch pine plank after gluing two pieces together edgewise. The amount to be scooped out is given in drawing as one-half an inch; it may well be a little more than this. The legs and rails should be made of some wood that will not easily splinter in modeling the sharp corners at the bottom of the legs. Butternut or gum of the soft woods will be satisfactory and oak will probably be the most suitable of the hard woods. Turned legs make an attractive piece.





15—Hall Umbrella Rack

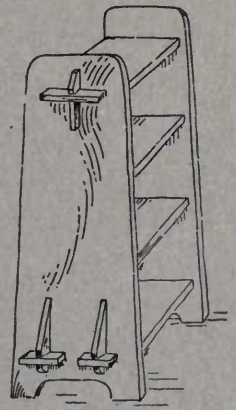
An eighth grade problem. Chestnut has been used with considerable satisfaction and success in the construction of this project. As indicated in the article by the author in the Manual Training Magazine for April, 1906, there is a chance for study in filling in the sides to make a good panel scheme. It is believed that the horizontal strips alone may be used with much satisfaction if those near the bottom are placed farther apart than those near the top, and not more than four are used on a side. An ordinary shallow sheet-iron pan colored by covering with lard oil and heating repeatedly in the fire will make a good bottom. A better pan, and one which will be more appropriate in color to harmonize with the brown stains, will be made of copper. This is a good piece for fuming.

16—Hat and Umbrella Rack

Preferably a high school problem, although eighth grade boys of unusual ability may work it out. If made of soft pine the corner posts may be cut from 2 x 4 in. stock and the center posts made from two 2 x 4 in. pieces with flat sides glued together. Soft pine with a good grain finished with a dark stain will make this a very appropriate hall piece. In gluing up, the diagonal cross pieces should be glued into the center post before the frame work is glued together; then as the last gluing on the framework is done, the center post with these projecting pieces, will be set inside and the ends slipped into the grooves (where the corners of posts have been sawed out to receive them) and bradded.

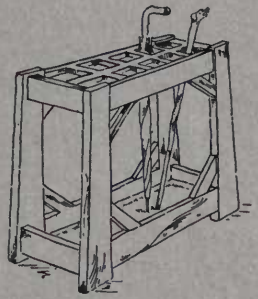
17—Library Book Shelves

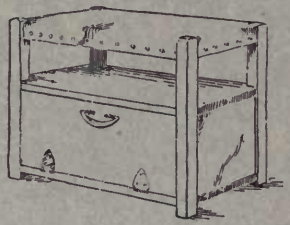
An eighth grade or high school problem in gluing and pinning. In gluing pieces together for shelves and sides dowel pins should be used, especially for the sides. Care must be taken when binding pins are fitted to have the inside of hole for pin cut away enough to allow the inside edge of pin to draw against the upright piece. This will make the shelves firm and substantial. Finish by filling wood—chestnut or oak—and rubbing down two coats of varnish. Hard pine stained will also make an appropriate piece.



18—Vestibule Umbrella Rack

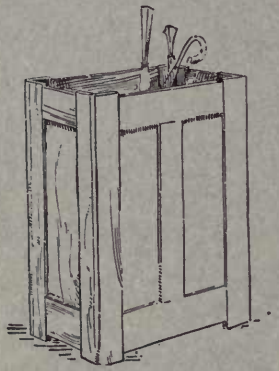
A high school problem. Make of oak and finish dark. As this is an outside piece it may well be finished by applying two or three coats of hot boiled linseed oil. The use of shellac or varnish will not be very practical. The corner boards are not necessary for strength. Inasmuch as they are decorative only, some other plan of space decoration may be used. A combination of horizontal and vertical strips is suggested, as in the hall umbrella rack.





19—Cabinet Stool

A high school problem which introduces simple cabinet construction, including the fitting and hanging of a single board door. Doors may be made for both sides, or one side may be made solid, in which case the board which forms the back should be grooved into the legs. This construction should also be used in fastening the end boards. This project serves to correlate metalwork with woodwork and offers an opportunity for the design and construction of copper, brass or iron hinges and pulls. Make of quartered oak and fume if either of the first two metals are used for fittings. In case iron is used for the metal parts, finish with the "Old Dutch Finish" or some dark stain.

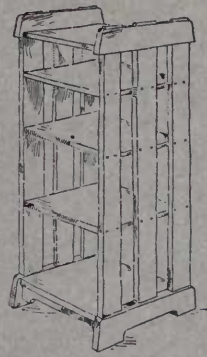


20—Umbrella Rack

A high school problem introducing paneling. The panels may be omitted in which case the project should be possible in the eighth grade. The tenon-and-mortise joint is recommended although the ends of rails may be halved into the corner boards. Metal straps fitted around the corners in line with the rails will form an appropriate decoration and will serve, also, as constructive elements. Make of chestnut or oak and fume, or finish with asphaltum varnish. Avoid the use of a finish which is susceptible to moisture.

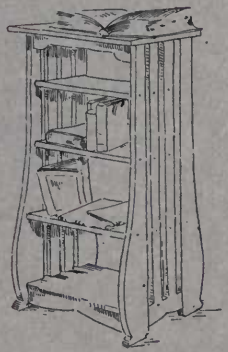
21—Magazine Holder

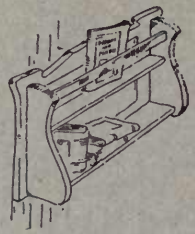
An eighth grade or high school problem. Fair problems in gluing (for shelf width) screwing, tenon-and-mortise construction and modeling are presented in this project. The open mortises at the top should be cut from both sides of the rail to insure a good joint. Some close-grained or hard wood should be used for this piece to make of it a strong piece of furniture.

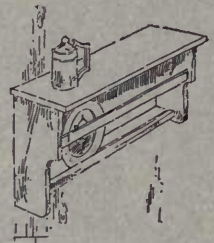


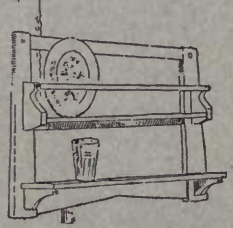
22—Magazine Holder

An eighth grade or high school problem. Butternut finished with acetate of iron made by soaking iron filings in vinegar will make of this a pleasing piece of furniture. A variety of designs is possible in this project but the one given has proven a popular one in the author's classes. If the corner boards are given a straight taper instead of a compound curve as shown, good results will be obtained. In this case the rails at the top and bottom may very appropriately be changed to straight-line modeling.









23—Wall Book-Shelf and Magazine Rack

A high school problem. The design may be modified and possibly improved by allowing the boards at the end of the back to taper toward the bottom on the outside, making the width about three and a half inches. The most difficult work comes in making the back which is an ordinary problem in panel framing. A dilute logwood stain on chestnut or oak will give a dark finish.

24—Plate Rack

An eighth grade or high school problem. This is a modification of the ordinary style of plate rack. It harmonizes in its design with the present-day severe style of dining room furniture. Make of oak or chestnut and finish with the bichromate of potash stain.

25—Plate and Tumbler Rack

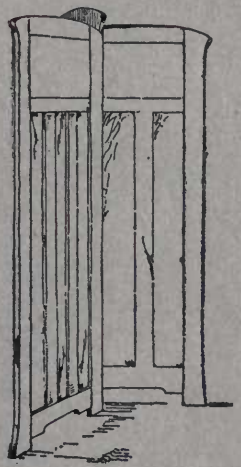
An eighth grade or high school problem of severe design but appropriate in a dining room furnished with so-called "craft furniture." A variation of the design may be made by paneling the lower opening. The piece should be finished dark to give the best general effect. If hard pine or oak is used some prepared dark stain will give a good finish. A very pleasing rich yellow brown is obtained on oak by using the bichromate of potash stain. If a deeper brown is wanted, rub the bichromate stain with boiled oil and burnt umber; apply wax or a thin coat of shellac.

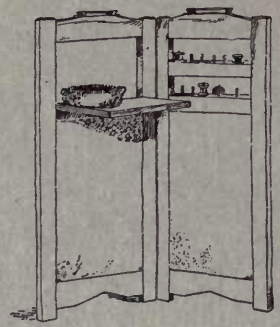
26—Chafing-Dish or Tea Table

A high school problem. Make of oak, preferably, and finish in brown. The doors may be made solid if well seasoned wood is used. The table will be quite as satisfactory in appearance if the shelf is omitted. The doors when let down into the horizontal position, serve as shelves for dishes. The ends of cross-bar supports for shelf are recessed into inside corner of legs and put into position as table is glued up.

27—Three-Panel Screen

Poplar or oak will be suitable for this piece. In the construction of this project different members of the same class may be put to work on the three different panels. If burlap or leather is used for the upper panels it may be fastened on a pine frame to set in flush with rails and stiles, or the material may be fastened on the outside with large-headed tacks. An opportunity is here given for some originality in design as these upper panels may be made of embossed or tooled leather, or stenciled burlap. If the wood is oak, some brown or dark green finish will be good.





28—Sewing Screen

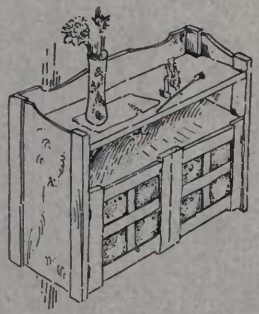
An eighth grade or high school problem. This simple two-fold screen permits of many modifications in general design. It is not a difficult problem in framing. Similar material tacked on to either or both sides of the frame may be substituted for the burlap panel. It may be made of almost any wood which should be stained, or stained and filled, and then covered with some preservative or waxed.

29—Wall Cabinet

A high school problem in simple cabinet construction. Great care should be taken to lay out and cut tenon-and-mortise joints to make them fit very tight—almost a driving fit. The cabinet offers a good problem in the design and construction of hardware. Chestnut or oak in the open-grained woods or poplar, birch or walnut in the close-grained woods is suggested as suitable material. Any one of the latter named woods may be finished in the natural, or stained and then finished with a low-toned varnish. The first named woods should be stained, filled, and then varnished or fixed and waxed.

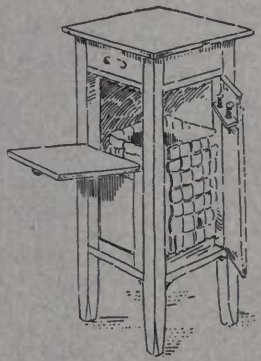
30—Wall Cabinet

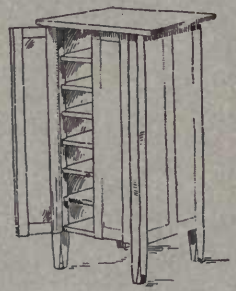
An eighth grade or high school problem, and an attractive library, study or dining room hanging piece. The colored glass for doors is in one piece for each door with copper strips (preferably burnished) set in to form part of the decoration, rather than an essential feature in the construction. The project may be simplified by making the back solid, using narrow matched lumber, or by gluing pieces together instead of paneling as suggested in working drawing. Finish dark to contrast with color in glass and with the bright copper strips.



31—Sewing Cabinet

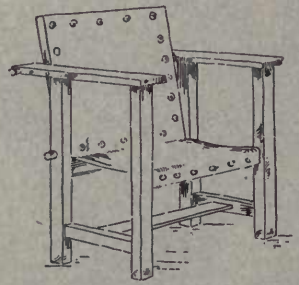
A high school problem in quartered oak. Plain oak or chestnut will be somewhat less attractive in appearance. The front and back panels are fastened in by first boring a five-eighths hole part way through from the inside (as shown by dotted circles in working drawing) and then driving one-inch screws from these holes into corner posts. This makes a very practical problem in paneling and general cabinet-making. Finish by filling and varnishing if a strong grain is desired; otherwise stain, or stain and fill, and apply wax or varnish.





32—Music Cabinet

A high school problem in cabinet-making. Make this piece of butternut, black walnut, mahogany or maple. Finish with varnish and rub down three or four coats to give a dull or egg-shell finish. In putting cabinet together glue sides up first; lay one side on floor with inside of side up and set back panel and shelves in position. Now place second side in position and fasten with glue.

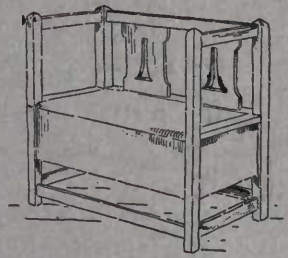


33—Library Chair

A high school problem. In design this is a novel modification of the Morris Chair. The seat and back should be covered with natural leather and fastened with large iron, brass or bronzed tacks which are given the "dead" rather than the bright finish. The leather of the seat should not be stretched very tight at first. A finish similar to the one recommended in the rocking chair is advised here, except that filler and stain may be brown to harmonize in color with the leather.

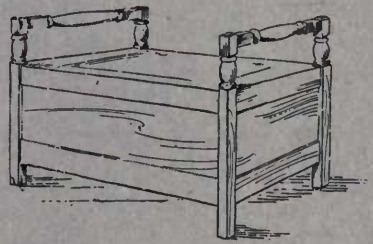
34—Hall Seat

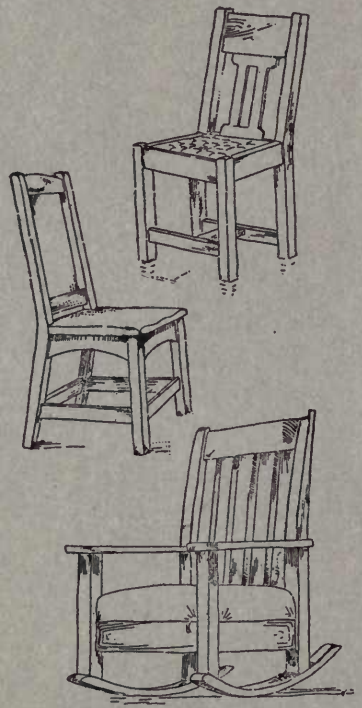
An eighth grade or high school problem. Make of hard pine, poplar or chestnut unless oak is desired. If poplar or pine is used some good stain that does not need a fixative preparation over it will answer all requirements. The design may be varied by using slats on ends and back instead of the two back boards as shown. If the seat is upholstered with leather or its imitation, pantasote, allowing a border of the wooden seat about two inches wide to show all around the uphosltery, the piece will be somewhat improved in appearance.



35—Hall Seat

A high school problem offering an opportunity for some wood turning. The chest portion of the seat might be made by using solid rather than paneled sides and ends. In any case these should be grooved into the legs. The seat will look best perhaps when made of some hard wood and finished by the process of staining, filling and varnishing. The turned parts should be finished while in the lathe if varnish is used, in order that it may be properly rubbed down.





36—Desk Chair

A high school problem. This makes a simple chair and one that brings in good framing problems. Hard pine or oak will be most serviceable. If a softer wood than either of these is desired, poplar may be used. In case an open-grained wood is used it should be filled. If the entire wood is to be colored, stain first and fill afterward. The natural wear on a desk chair calls for a finish which will preserve the stain; varnish or shellac should be the covering material.

37—Hall Chair

A high school problem. This is a suitable project for a boy who will take pride in matching the grain of lumber in gluing two pieces together for seat and back. Have the joint come in the center of each of these parts. A very satisfactory way of producing a striking effect is to resaw a piece and double the two parts back as one turns the leaves of a book, and then glue the edges together. Cypress, sycamore or hedge will be suitable wood. Finish in natural color with dull varnish or shellac.

38—Rocking Chair

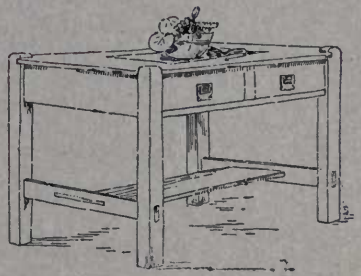
A high school problem. It is advised that this problem be undertaken only by high school pupils of considerable ability. The variety of angles introduced makes the cutting of joints difficult, although not too hard for some pupils of high school grade. The back cushion is left off in the sketch to show the slatted back. The cushions may be made by pupils. Pantasote may be the outside covering. Make a canvas case first and fill with "Kapok," a material shipped from India and not as expensive as curled hair. It is suggested that the bottom of corner posts need not be set into rockers, as shown in working drawing, as one will not rock back of the back posts. Stain dark and give the "Stain, Filler and Varnish Finish."

39—Library Table with Shelves

A high school problem. Make of chestnut or oak. Glue up the four sets of corner posts first. Second, glue in shelves and panels which form the backs for shelves, and, last, fit on top and foot board, being careful to have legs plumb and ends of table parallel in order that drawer may slide both ways. Finish in the "Old Dutch" style.

40—Library Table

A high school problem. This is a very simple table but a very good one. Oak should be used although chestnut will give a good finish if a soft wood is desired. In either case, unless one has the facilities for fuming large pieces of work, the wood should be wet after all parts are glued, sandpapered and scraped. When dry, sandpaper again; then stain and fill before the wax, shellac or varnish is used. The bichromate of potash finish will be very attractive on this piece. The drawer pull is made out of one-eighth inch sheet brass or copper.



41—Writing Desk

This is probably the most difficult problem in cabinet-making in this book but the desk may be satisfactorily constructed by high school pupils of unusual ability. The problem of paneling in front and back (the same in each) is a good test of technical skill. The lower part of the front when lowered to a horizontal position, catches under the middle shelf and forms the writing table. The back and top are fastened in position by method described in the notes on the sewing cabinet. The bichromate of potash finish or some dark stain will be suitable. If the stain is one that is on the wood instead of in it a covering of shellac or varnish should be used.

42—Bookcase

A high school problem. There is introduced in this project the problem of glass paneling and leaded glass work. The back is made in two panels similar to the doors without the middle one-inch stiles. The ends should be glued up first and the case set up as described in notes on music cabinets.

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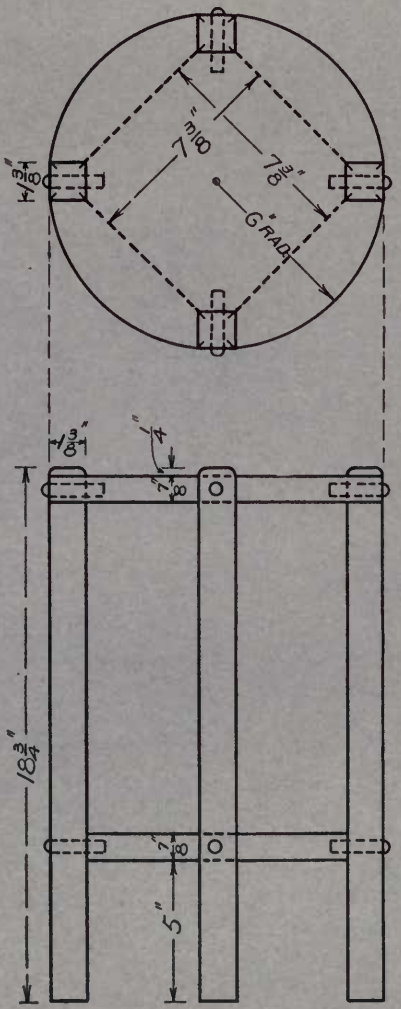
TABORET

FASTENED WITH R.H. SCREWS OR WOODEN PINS



W.T. BAWDEN, NORMAL, ILL.

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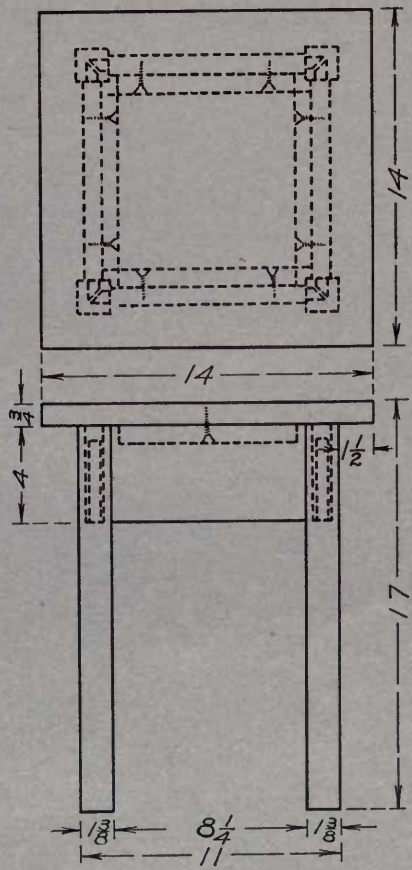
TABORET

T AND M FRAME CONSTRUCTION



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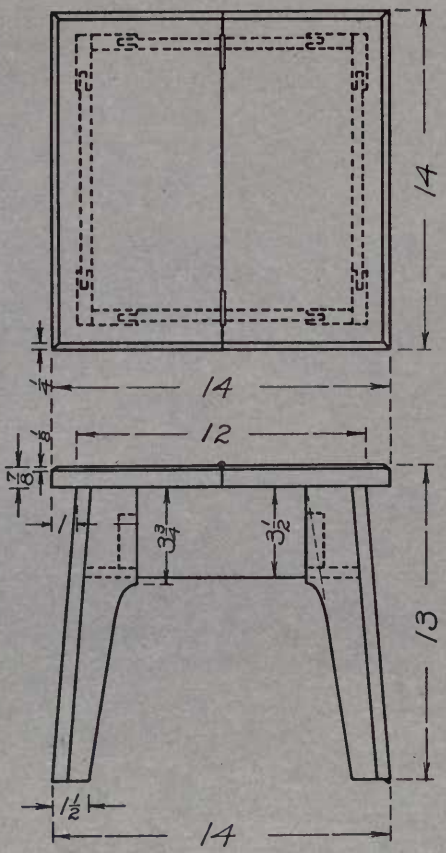
SHOE POLISHING BOX

ANGLE CONSTRUCTION



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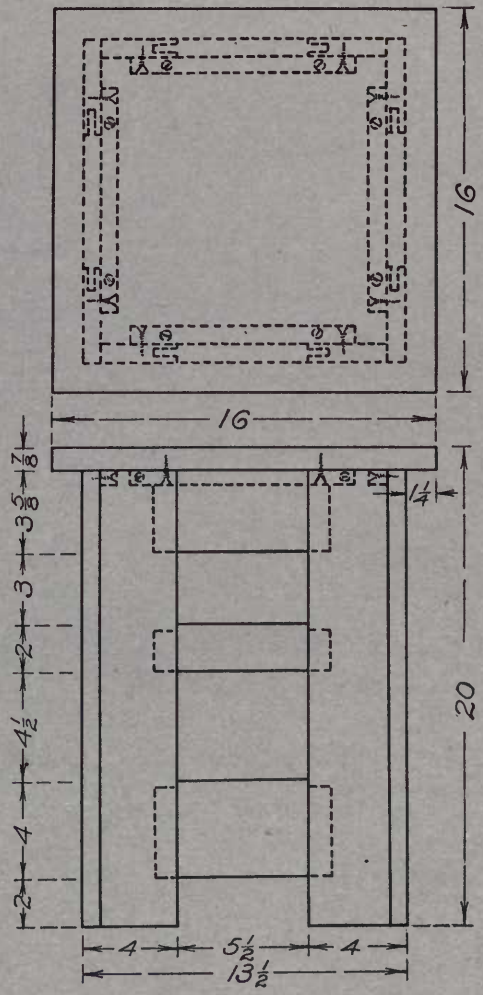
TABORET

COMPLEX TAND M CONSTRUCTION



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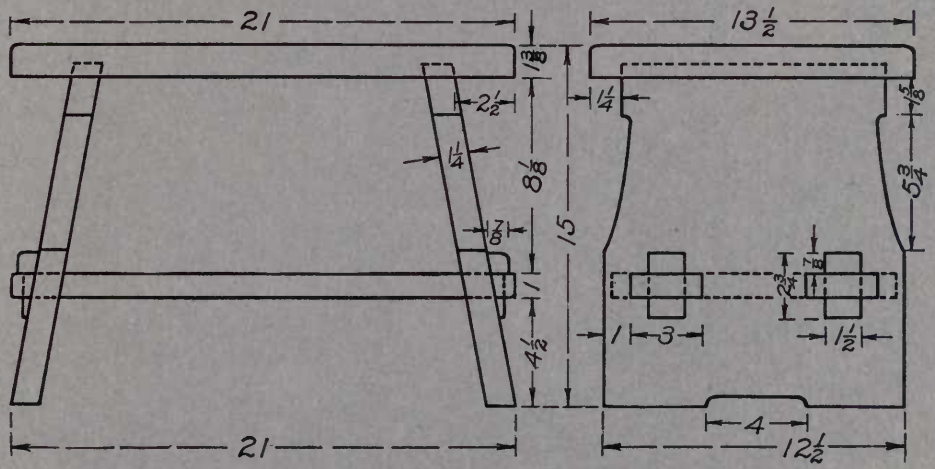
BENCH STOOL

T AND M PIN CONSTRUCTION



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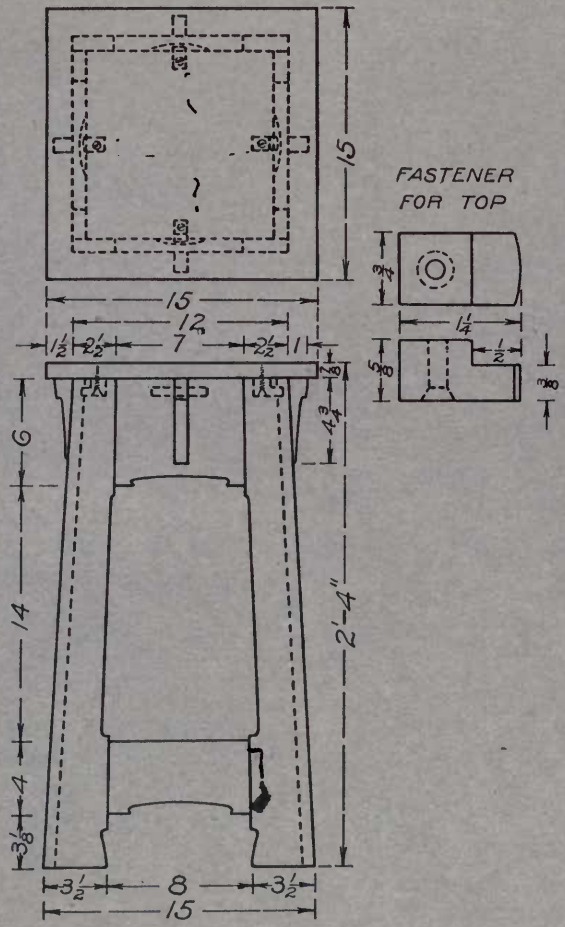
PEDESTAL



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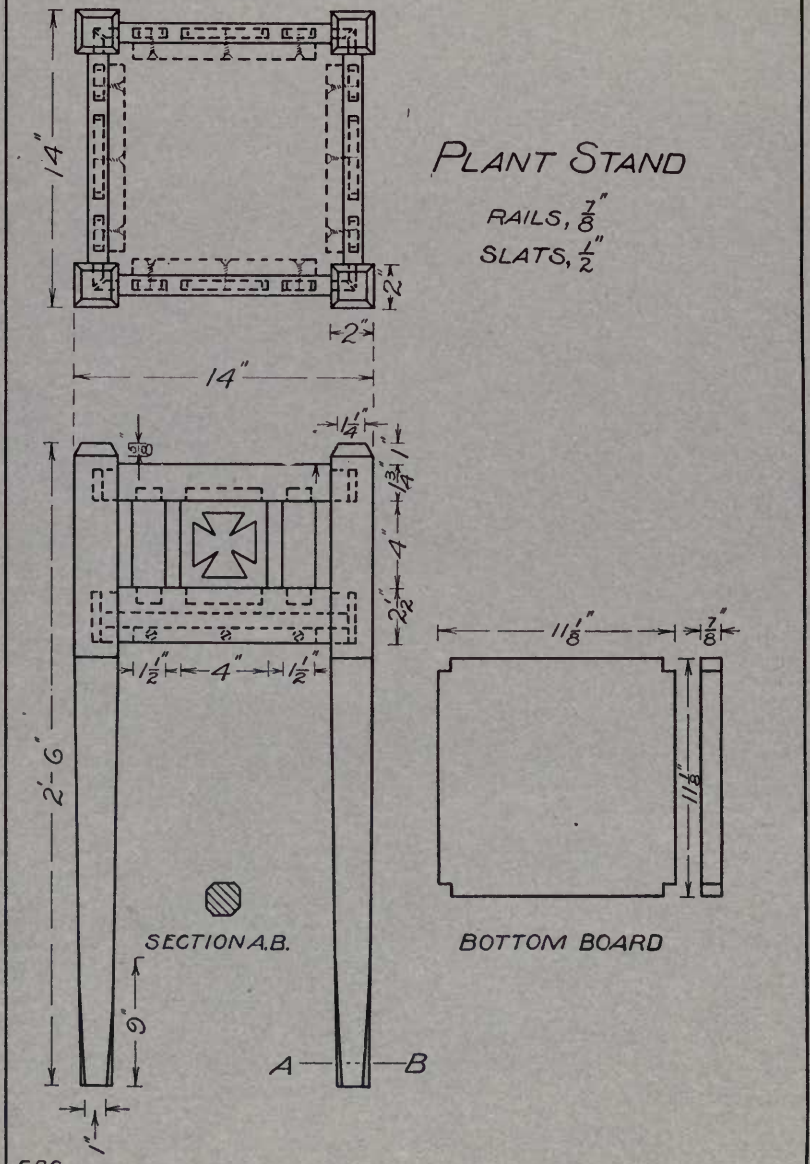

PLATE 7

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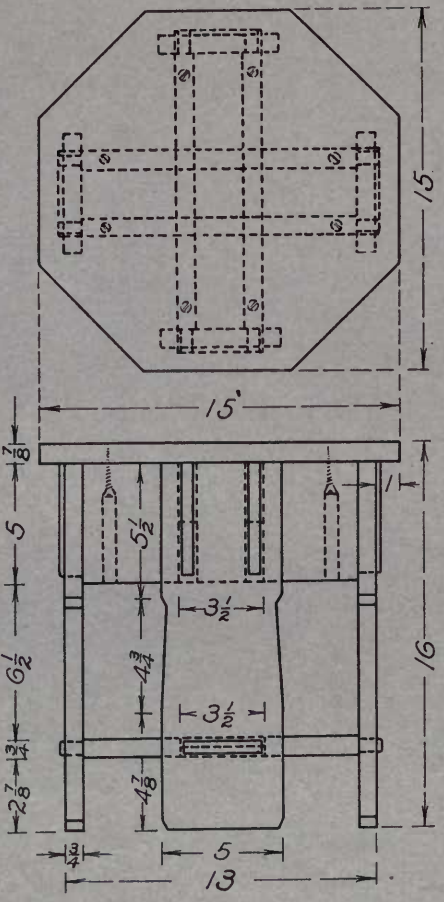
HALF LAP AND TANON CONSTRUCTION



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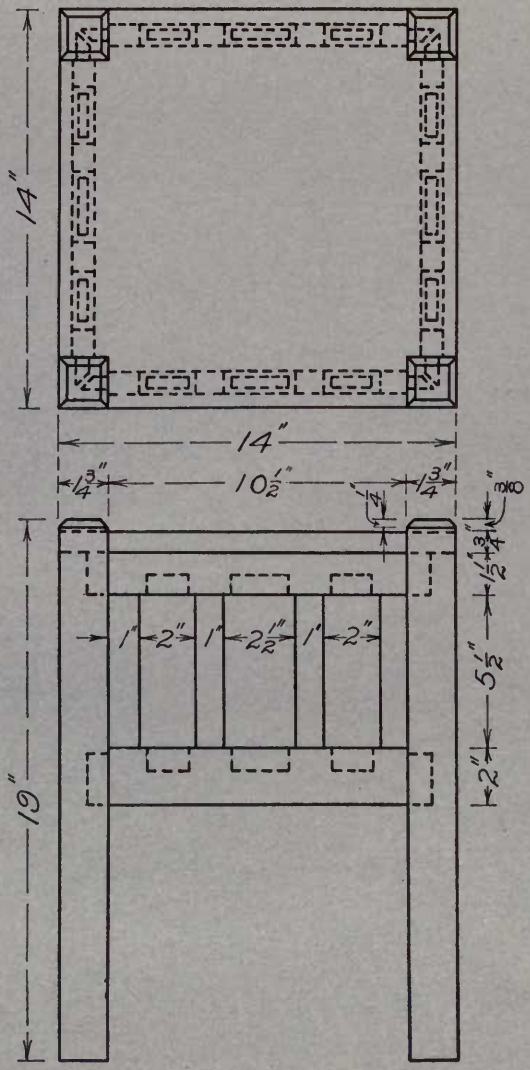
TABORET



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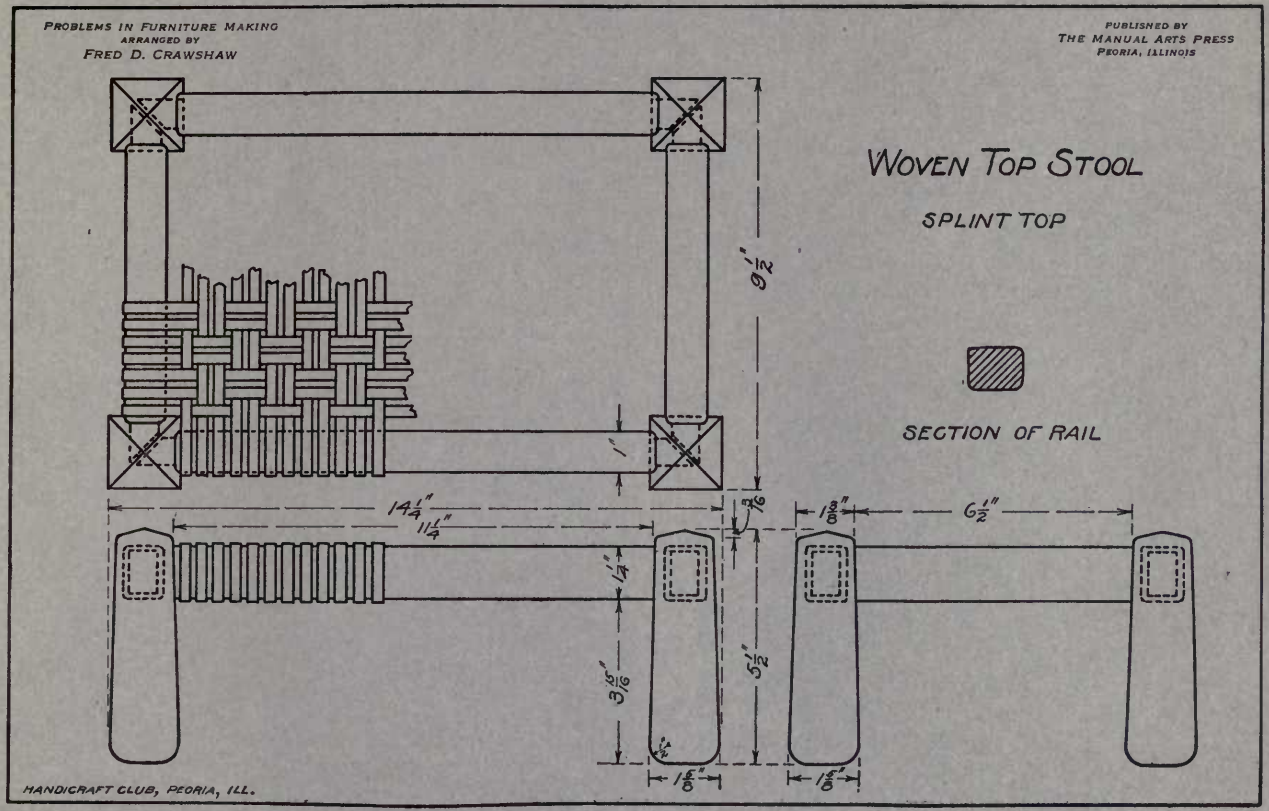
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WOVEN TOP STOOL
SPLINT TOP
SECTION OF RAIL
9½"
1"
14¼"
11¼"
⅜"
1⅜"
6½"
¼"
3/16"
5½"
1⅝"
1⅝"
HANDICRAFT CLUB, PEORIA, ILL.

PLATE 10

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WOVEN TOP STOOL

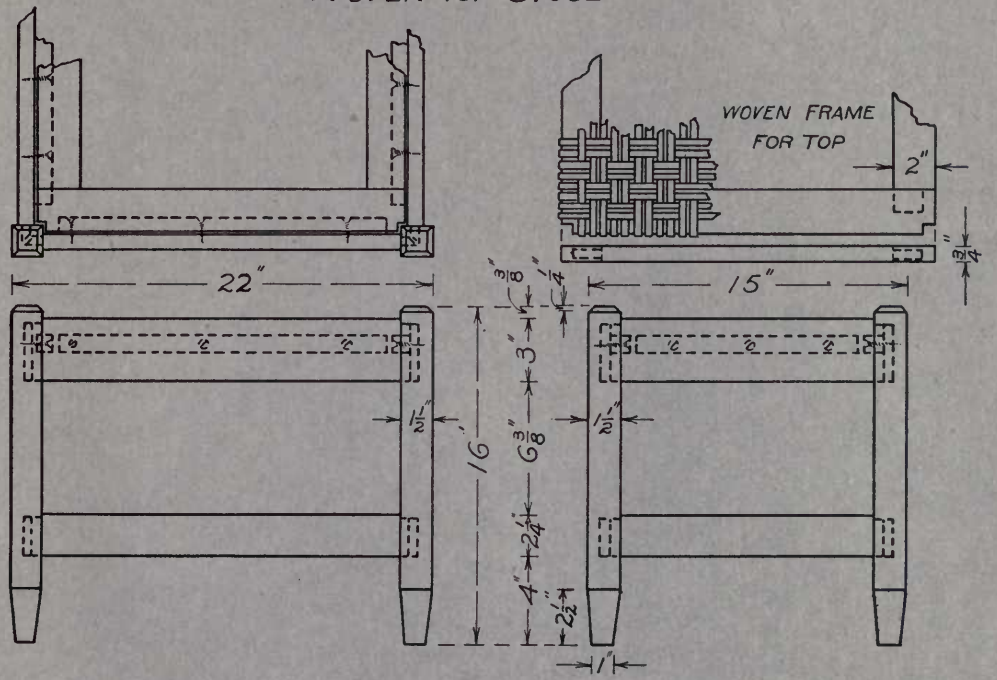

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PLATE 11

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LEATHER TOP STOOL

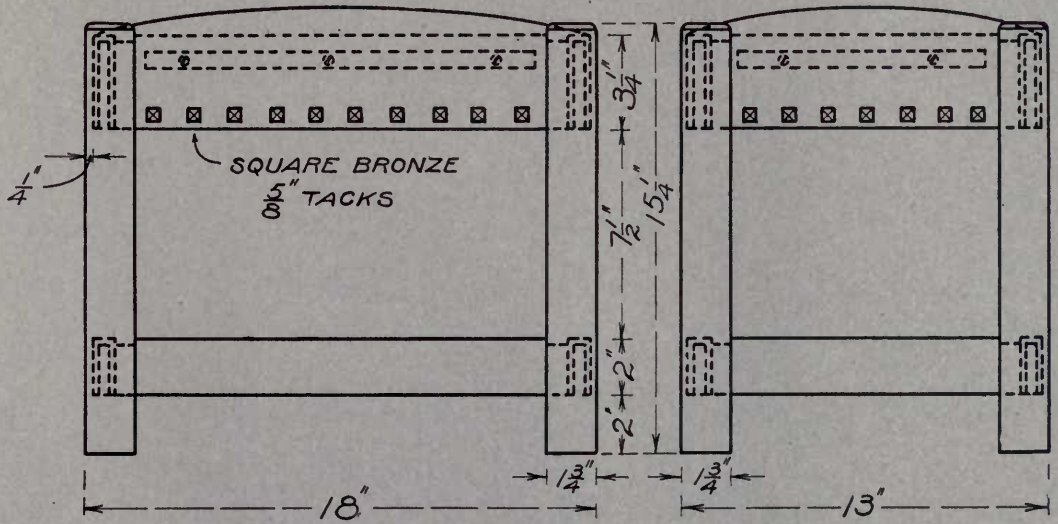

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PLATE 12

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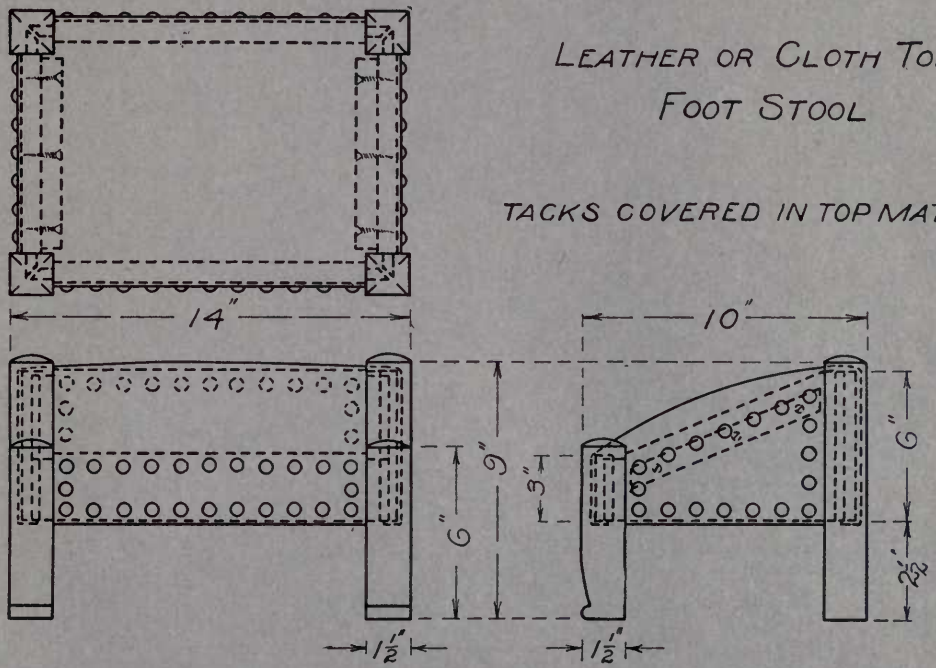
LEATHER OR CLOTH TOP FOOT STOOL

TACKS COVERED IN TOP MATERIAL



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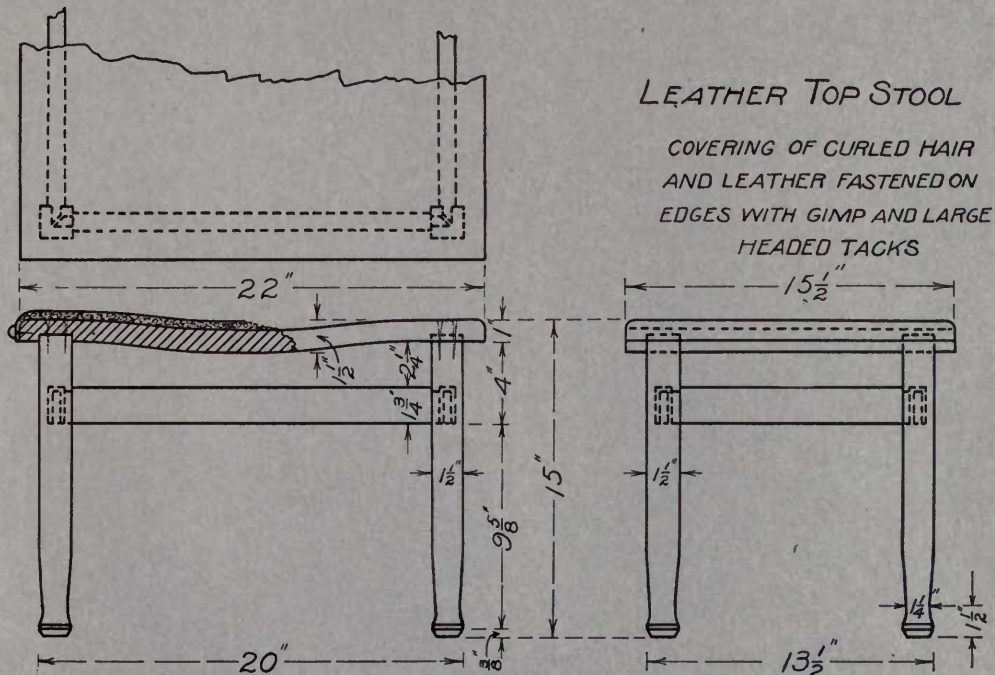

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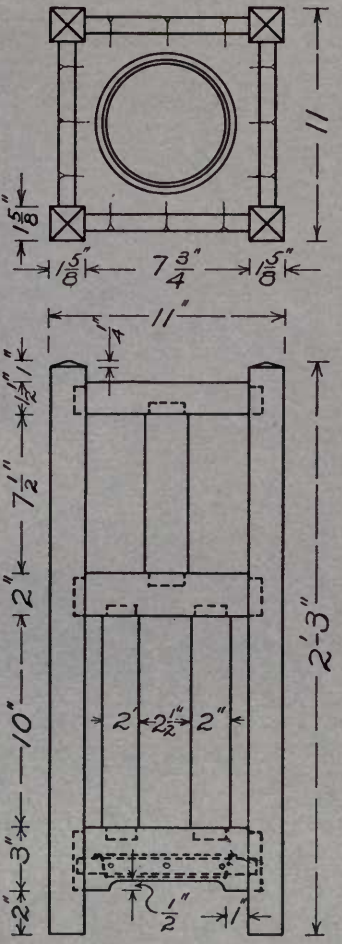
HALL UMBRELLA RACK

SHALLOW PAN SET IN BOARD FOR BOTTOM



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HAT AND UMBRELLA RACK

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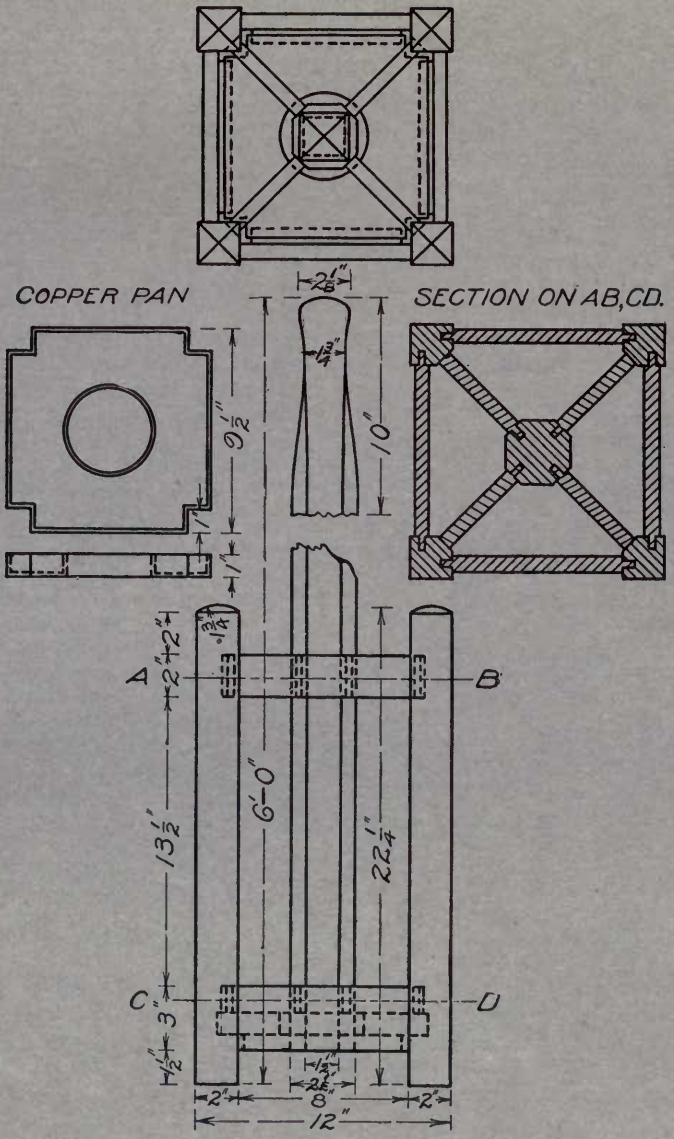

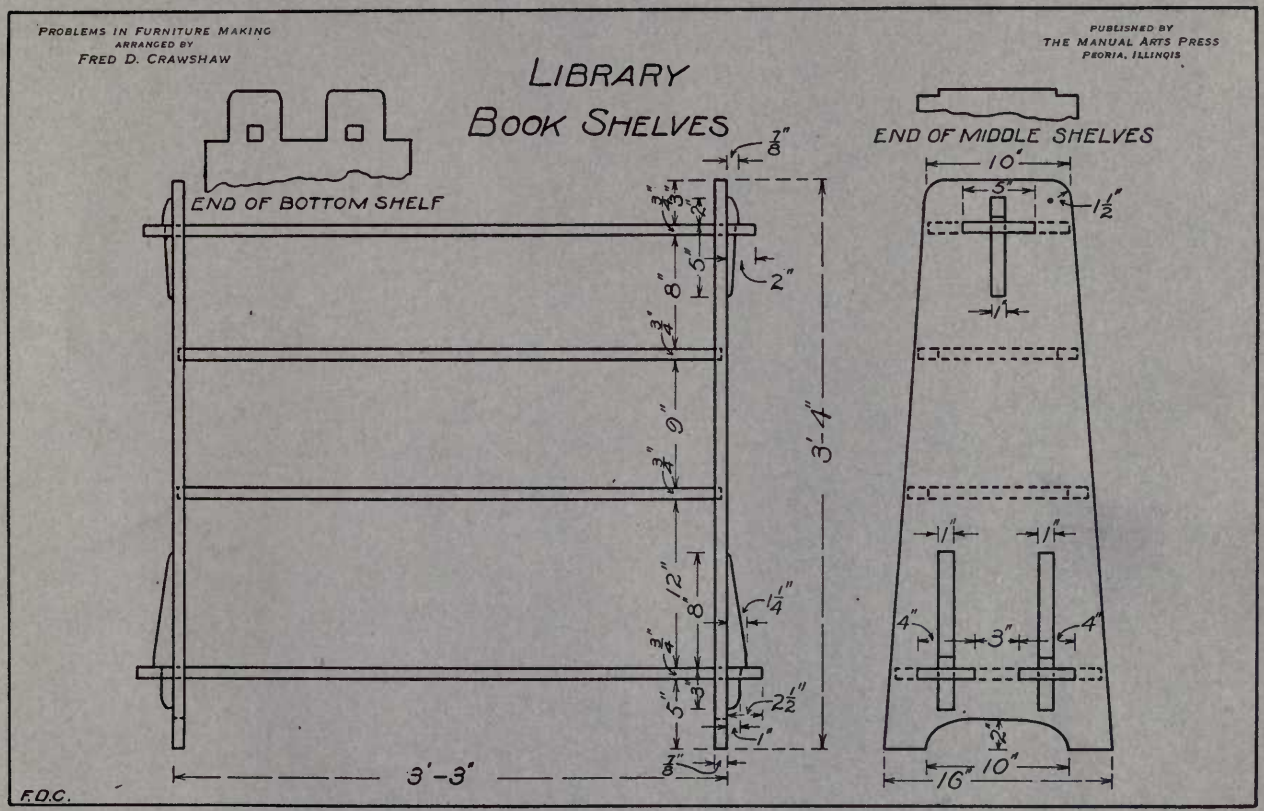
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LIBRARY
BOOK SHELVES
END OF BOTTOM SHELF
END OF MIDDLE SHELVES
3'-4"
3'-3"
10"
16"
F.D.C.

PLATE 17

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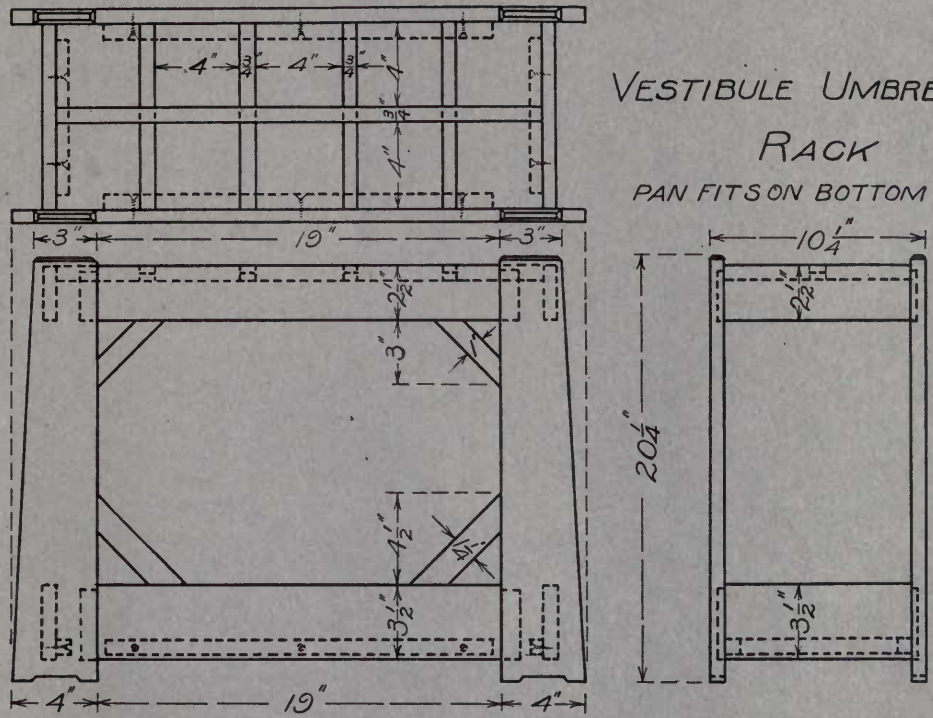
VESTIBULE UMBRELLA RACK

PAN FITS ON BOTTOM CLEATS



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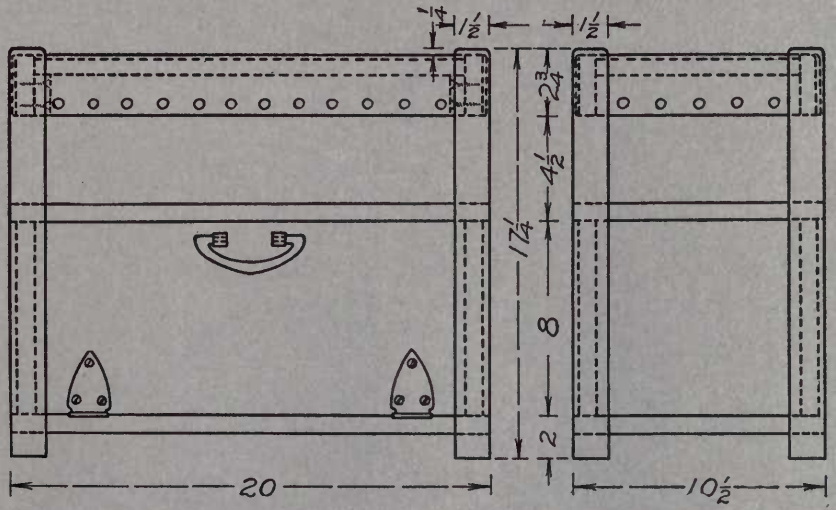
CABINET STOOL

LEATHER COVERED



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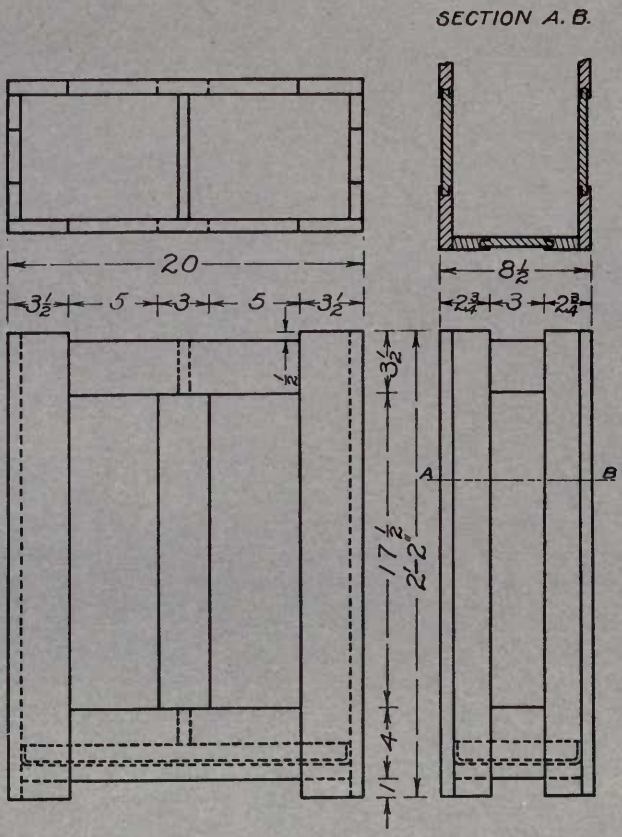
UMBRELLA RACK

PANEL CONSTRUCTION



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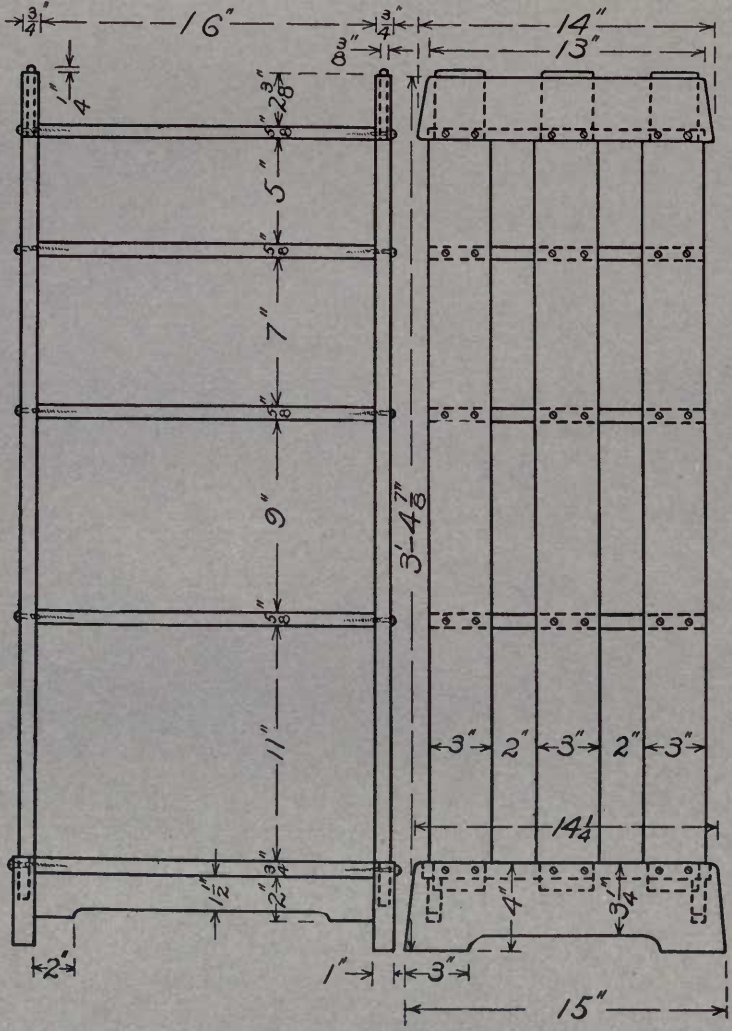
MAGAZINE HOLDER



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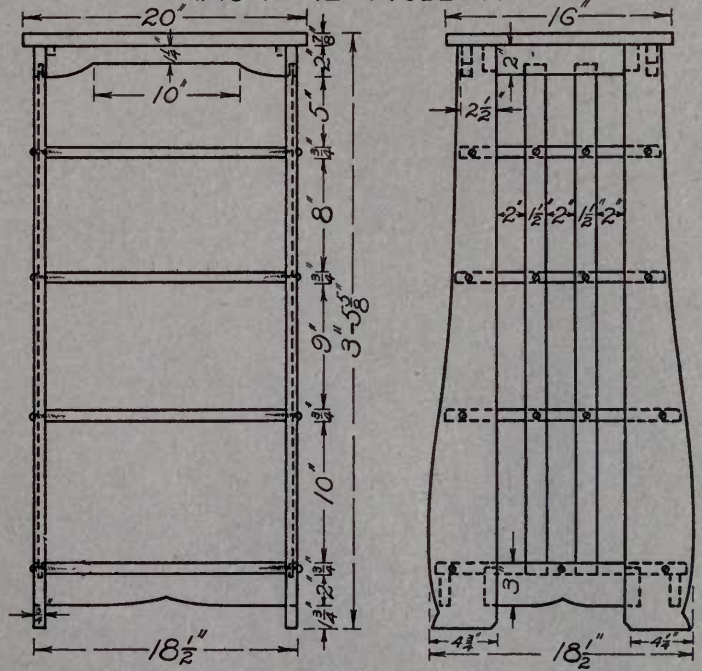
MAGAZINE HOLDER



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WALL BOOK SHELF AND MAGAZINE RACK

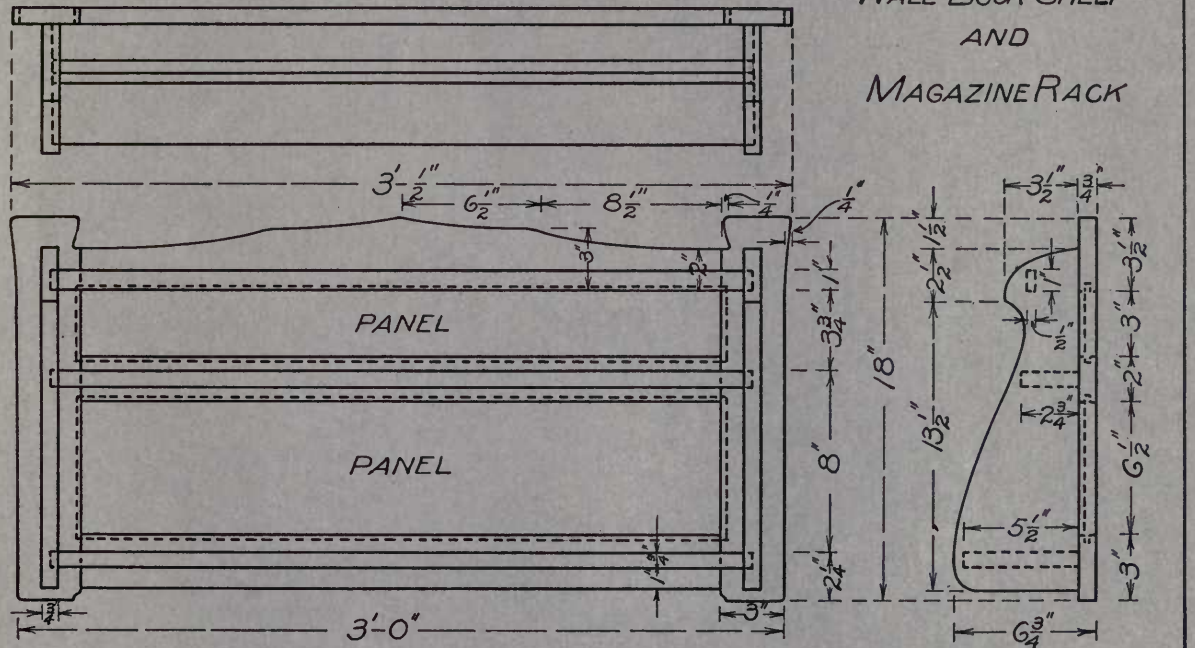

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PLATE 23

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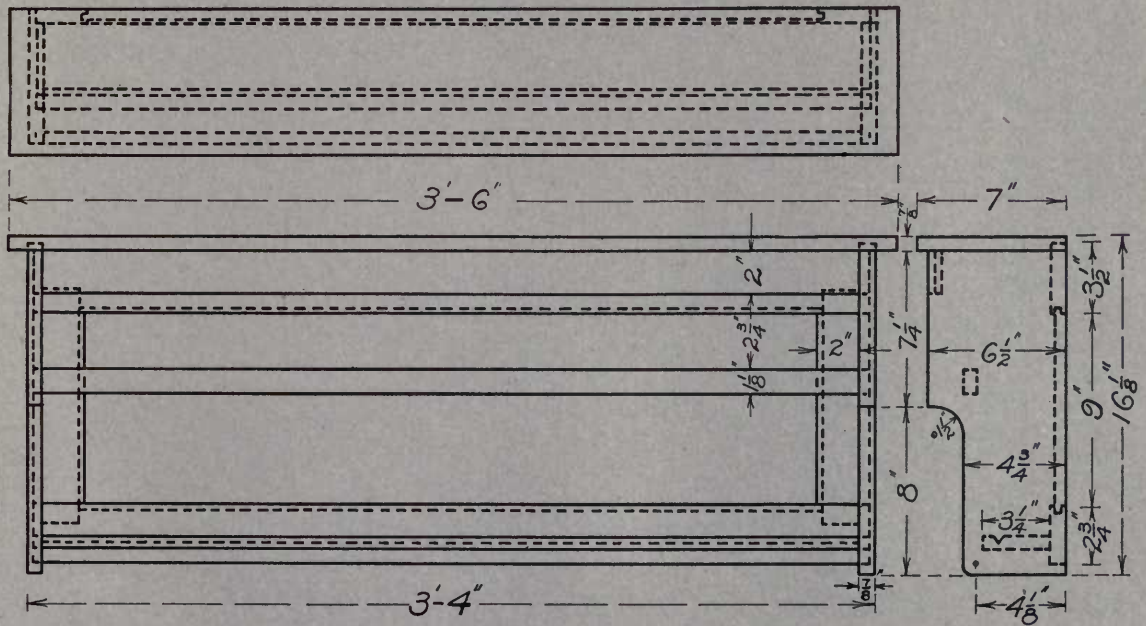
PLATE RACK



C.A. BENNETT, PEORIA, ILL.

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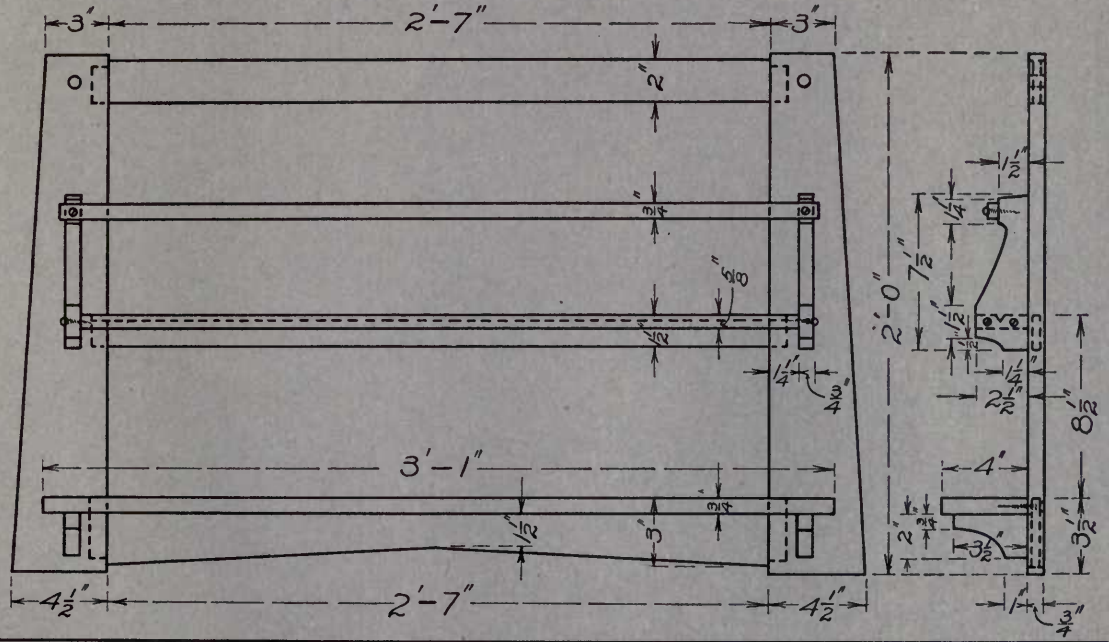
PLATE AND TUMBLER RACK



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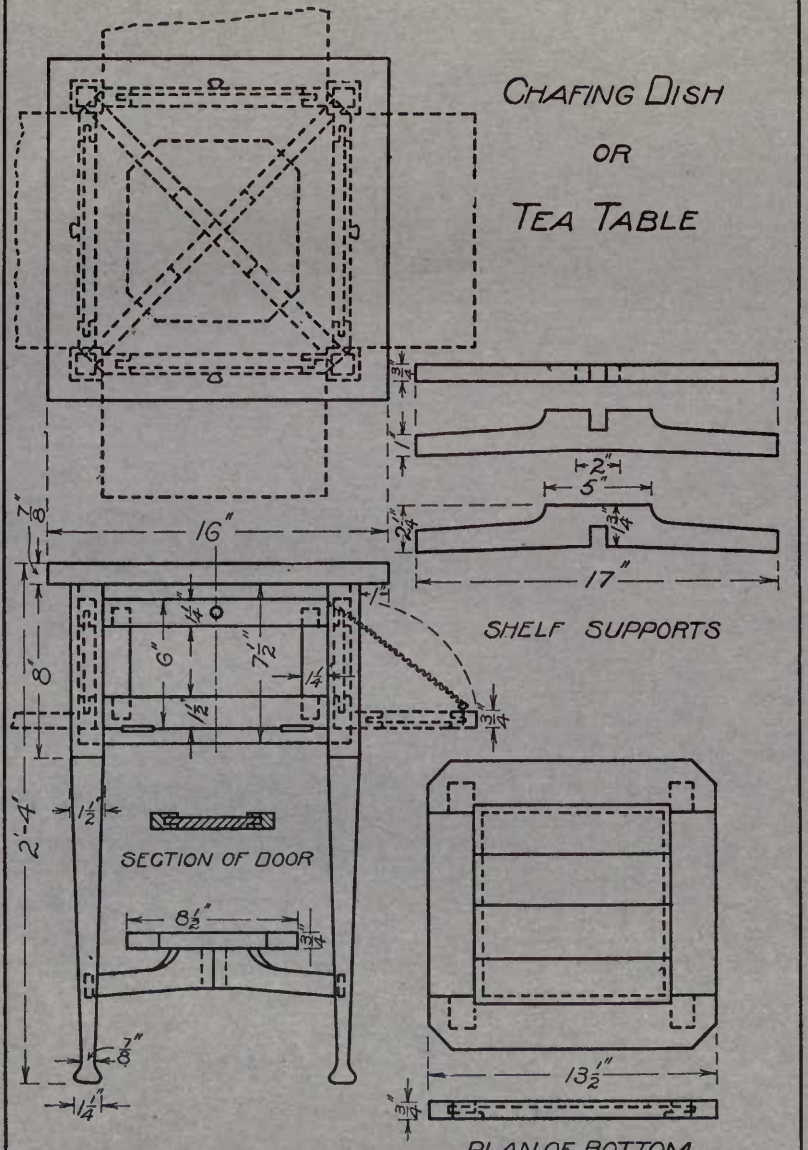
CHAFING DISH OR TEA TABLE



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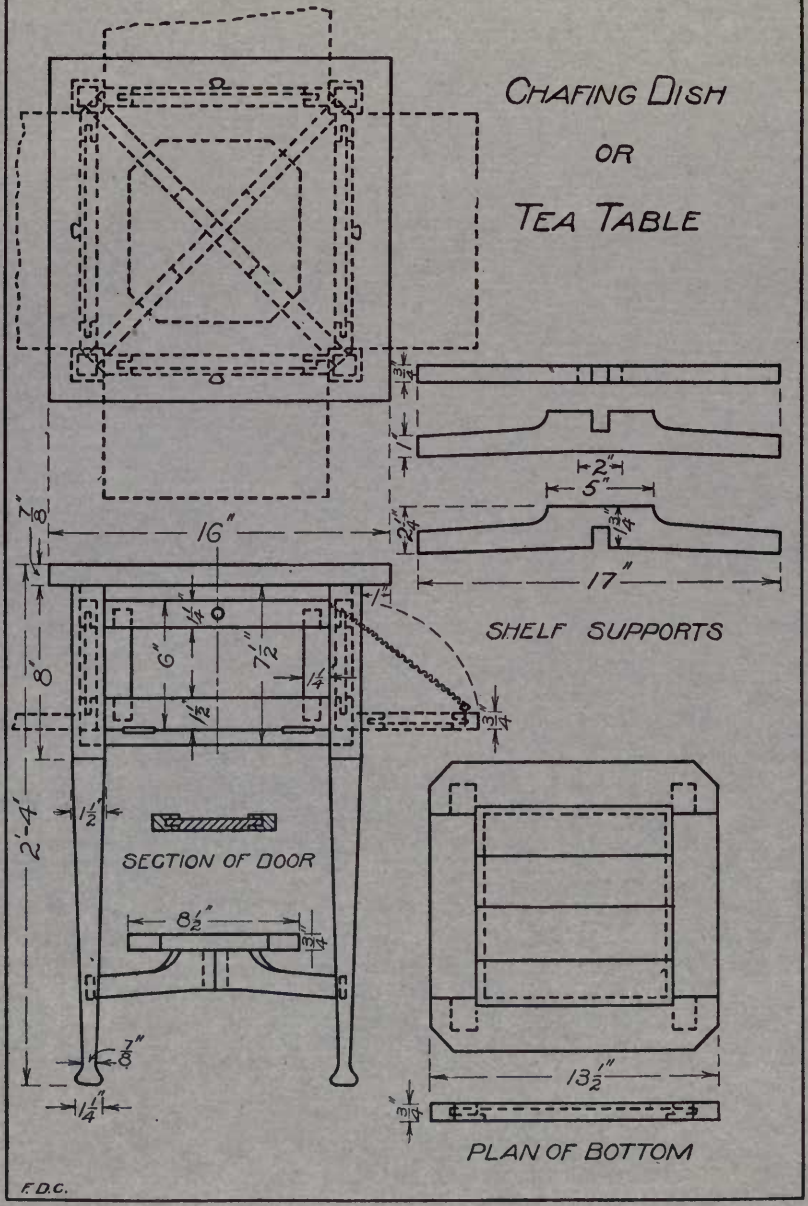

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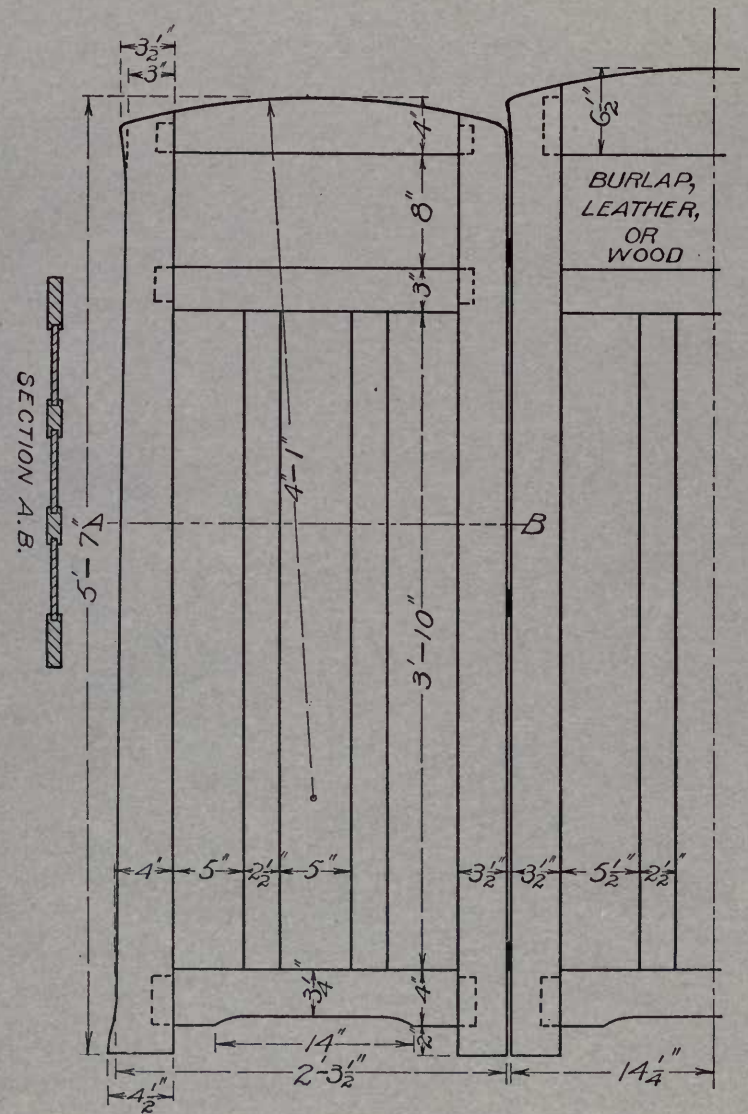
THREE PANEL SCREEN



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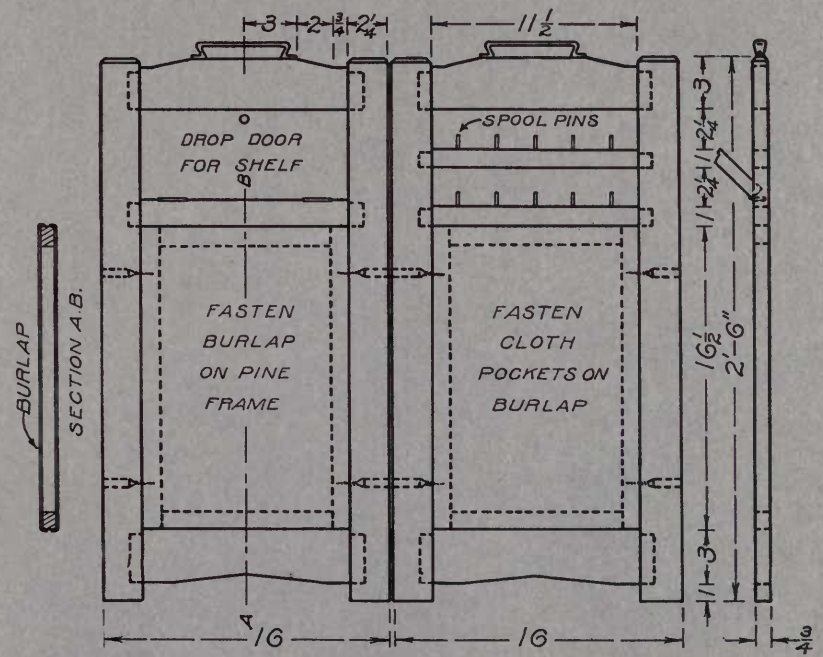
SEWING SCREEN



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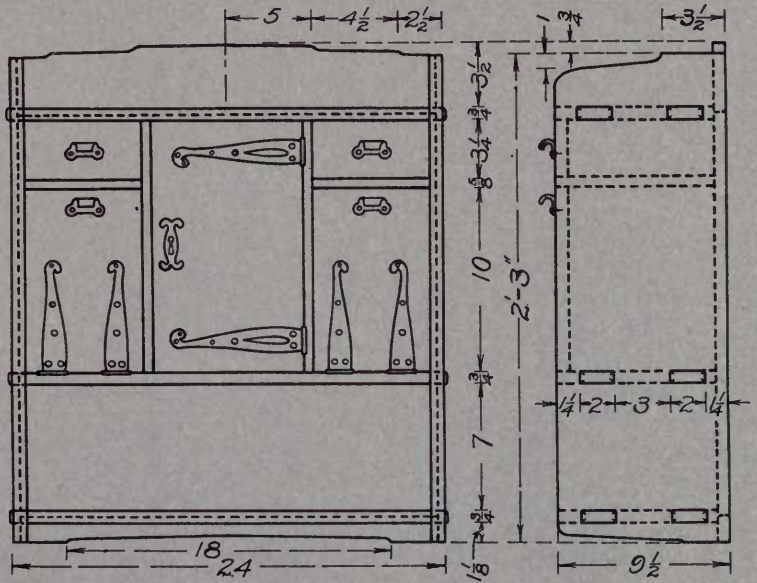
WALL CABINET



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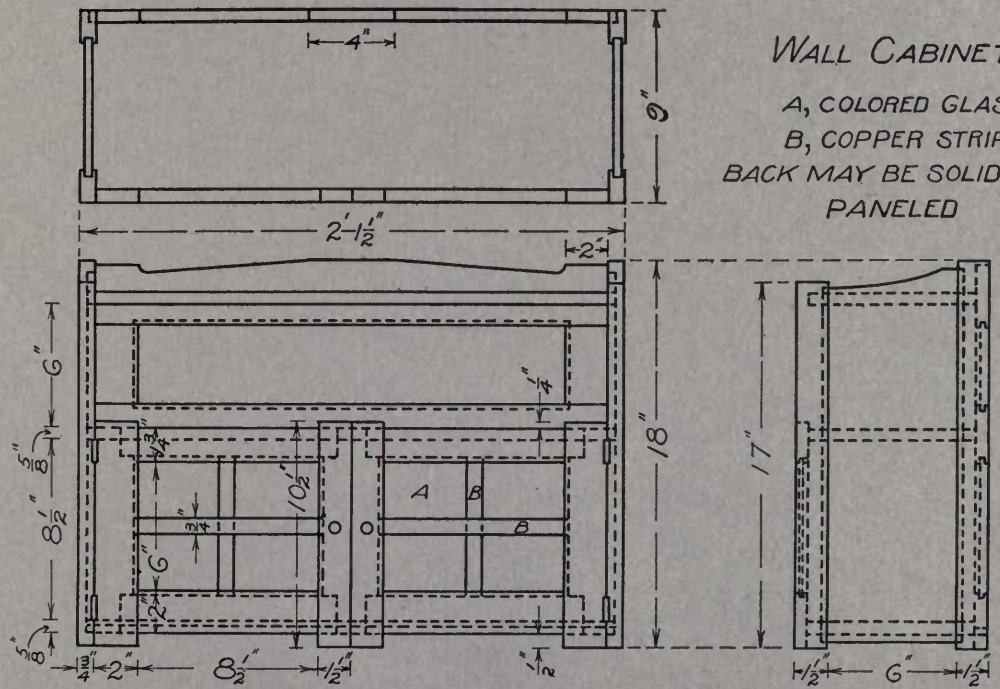

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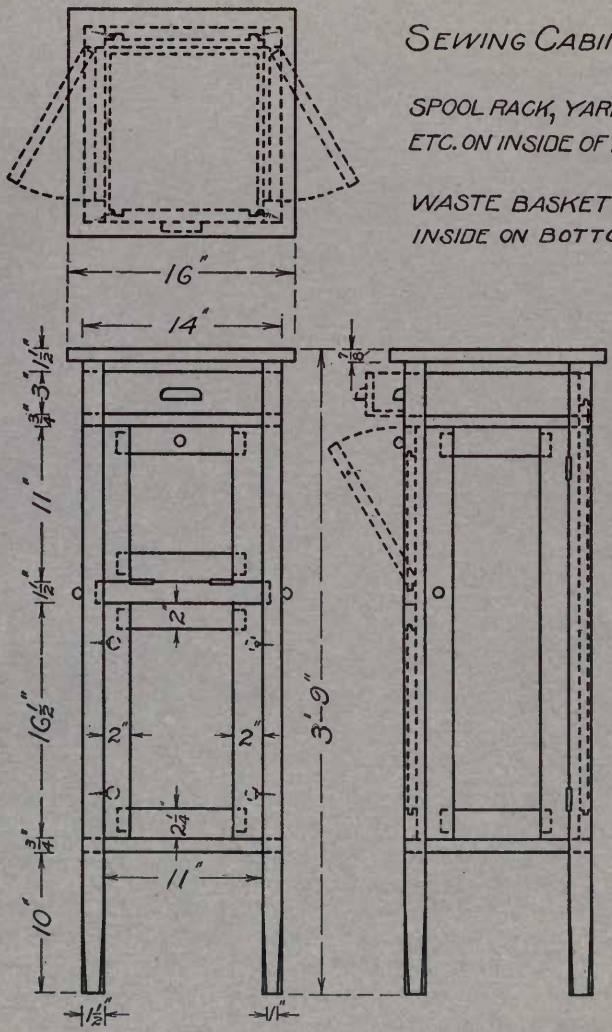
SEWING CABINET

SPOOL RACK, YARN BAG
ETC. ON INSIDE OF DOORS

WASTE BASKET SET
INSIDE ON BOTTOM



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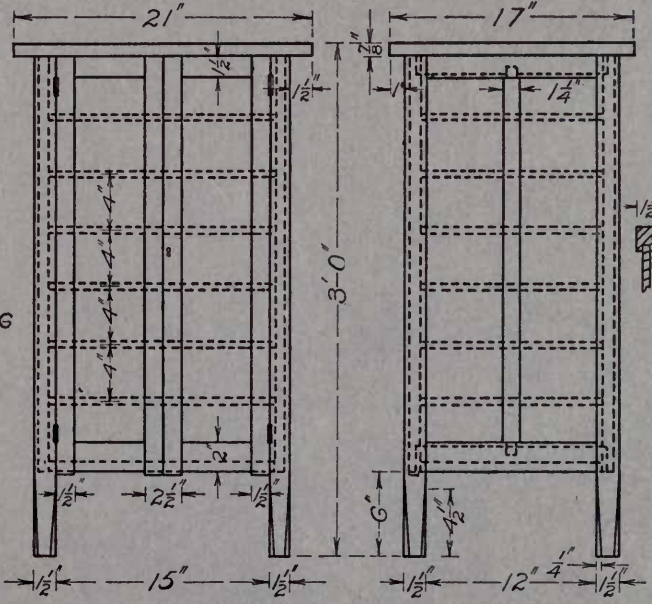
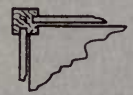
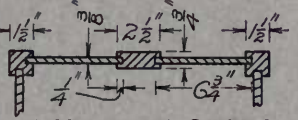
MUSIC CABINET





METHOD OF FASTENING SHELVES



HORIZONTAL SECTION THROUGH BACK

FDC.

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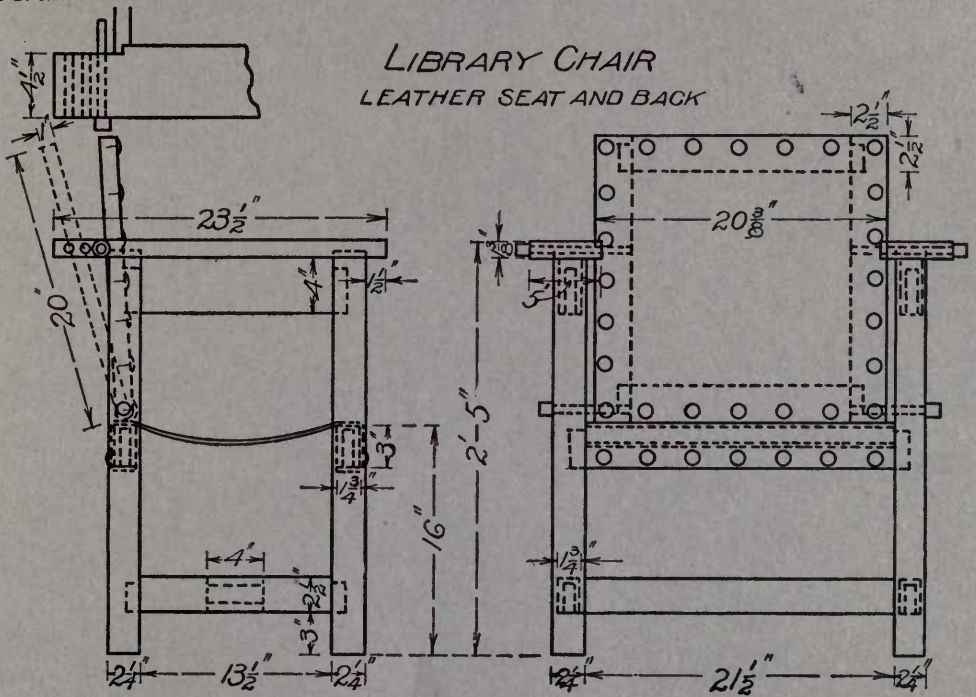
LIBRARY CHAIR

LEATHER SEAT AND BACK



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HALL SEAT

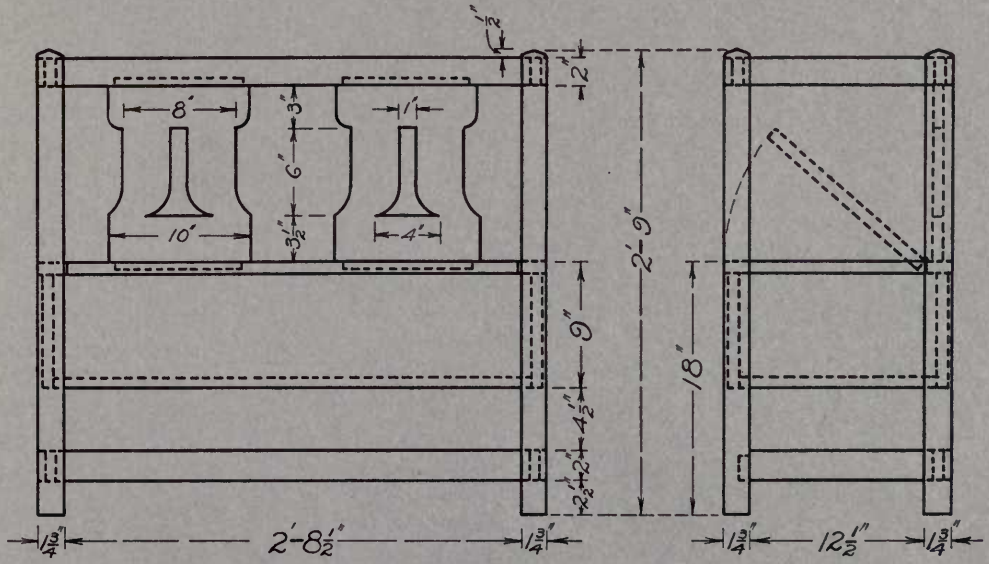

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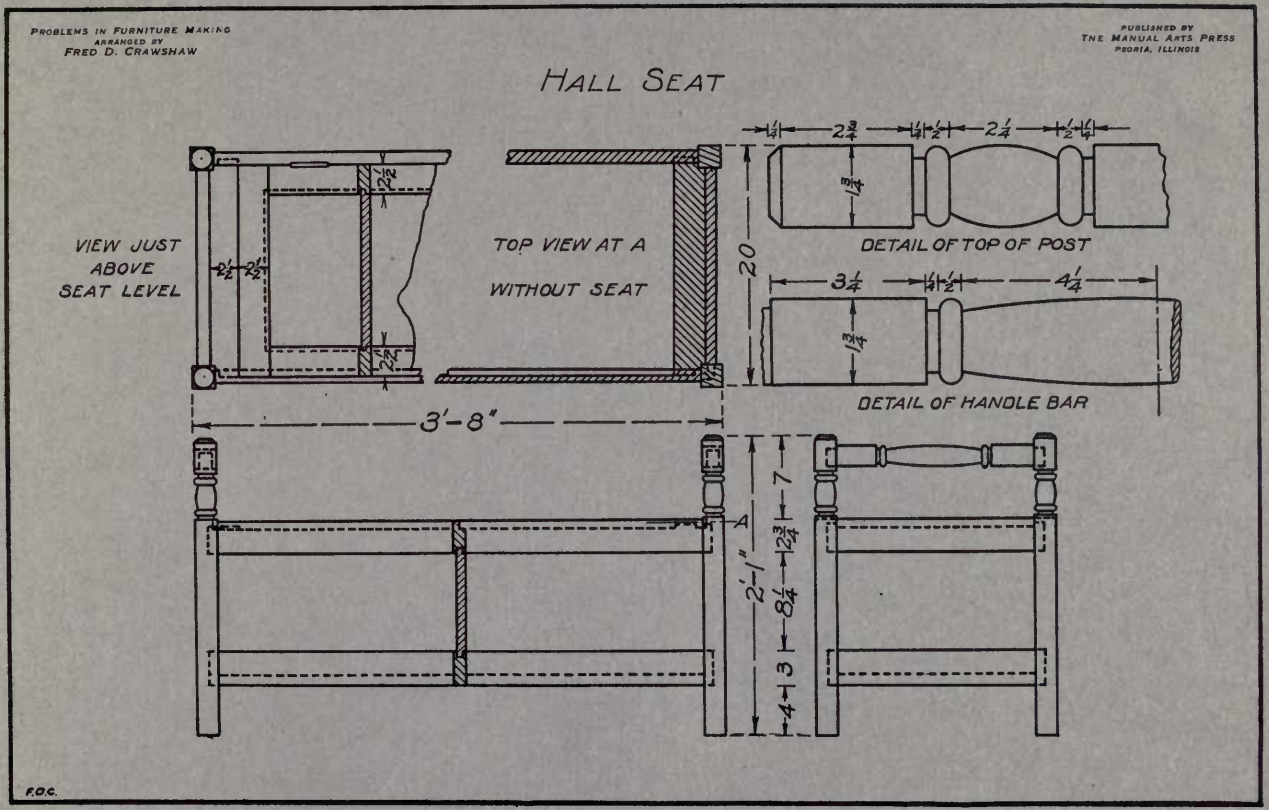
PLATE 34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HALL SEAT
VIEW JUST ABOVE SEAT LEVEL
TOP VIEW AT A
WITHOUT SEAT
DETAIL OF TOP OF POST
DETAIL OF HANDLE BAR
3'-8"
20
2'-1"
A
F.O.C.

PLATE 35

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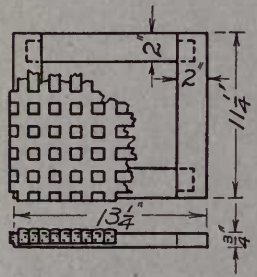
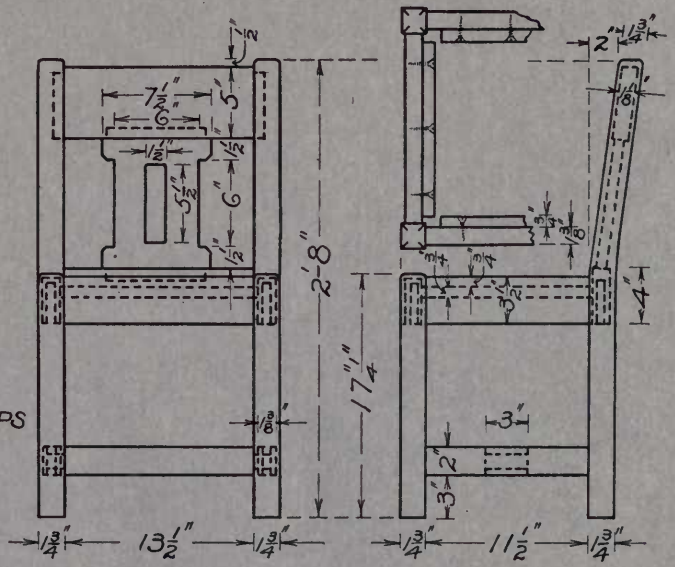
DESK CHAIR



CHAIR SEAT
WOVEN WITH 3/4" LEATHER STRIPS



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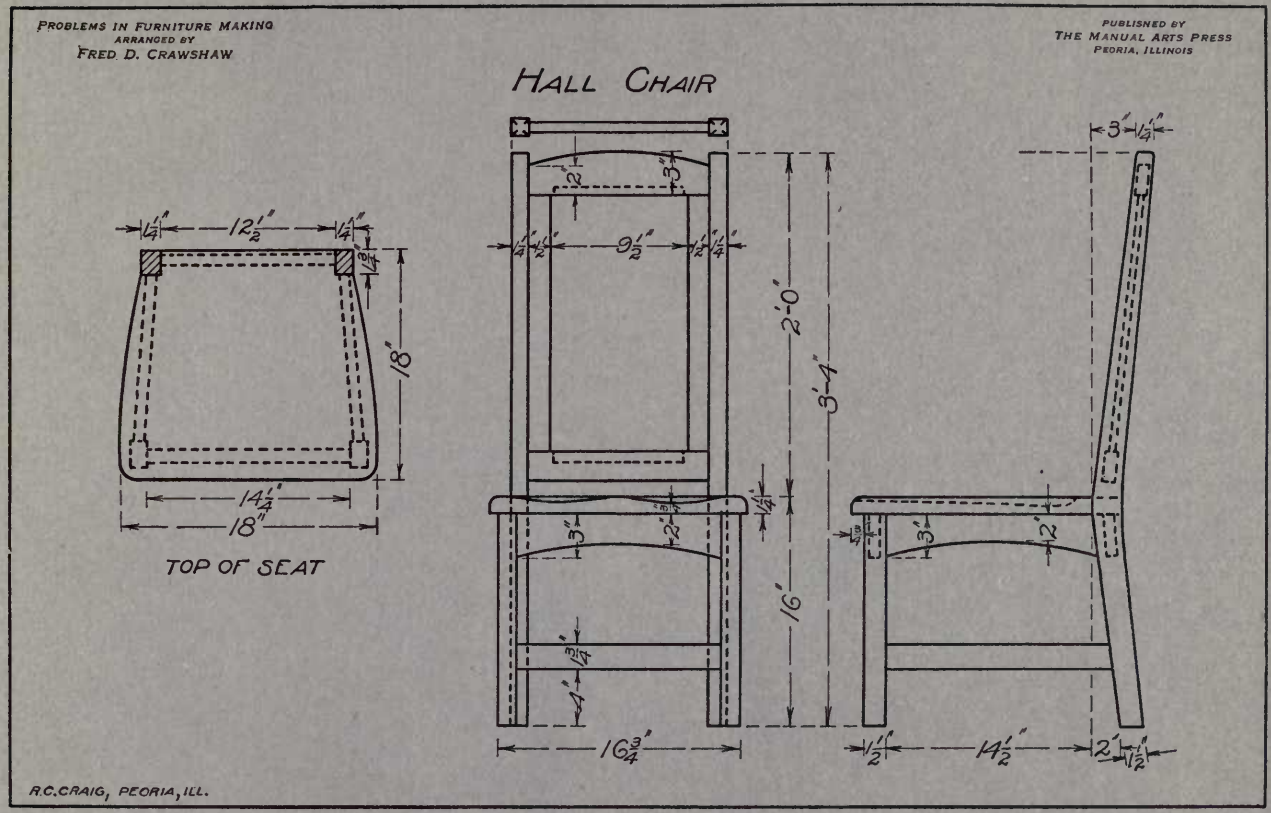
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HALL CHAIR
TOP OF SEAT
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PLATE 37

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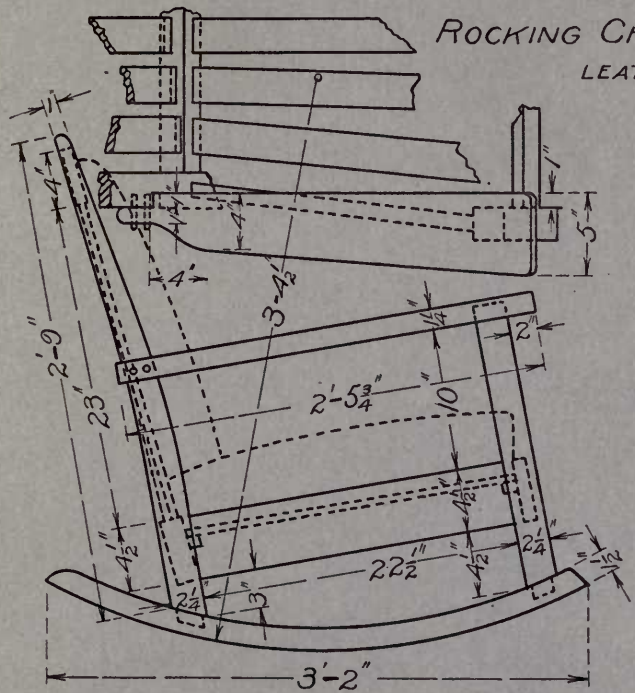
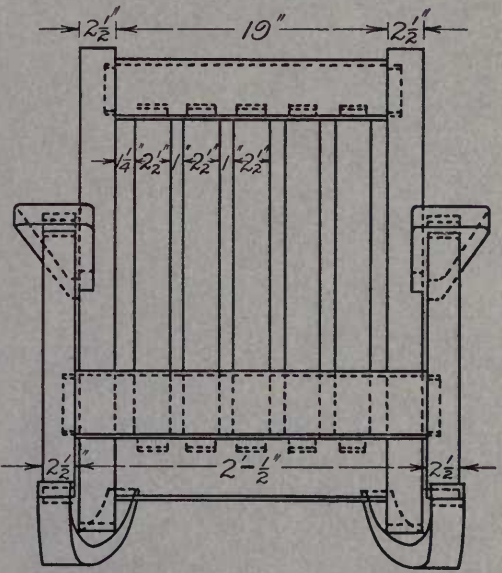
ROCKING CHAIR

LEATHER CUSHION ON SEAT AND BACK





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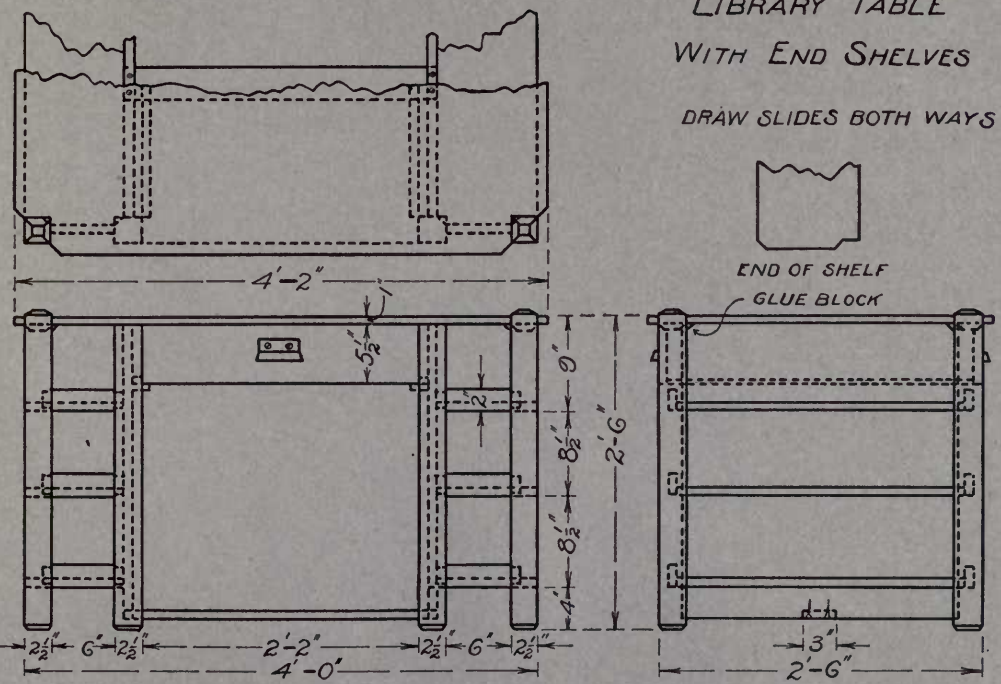
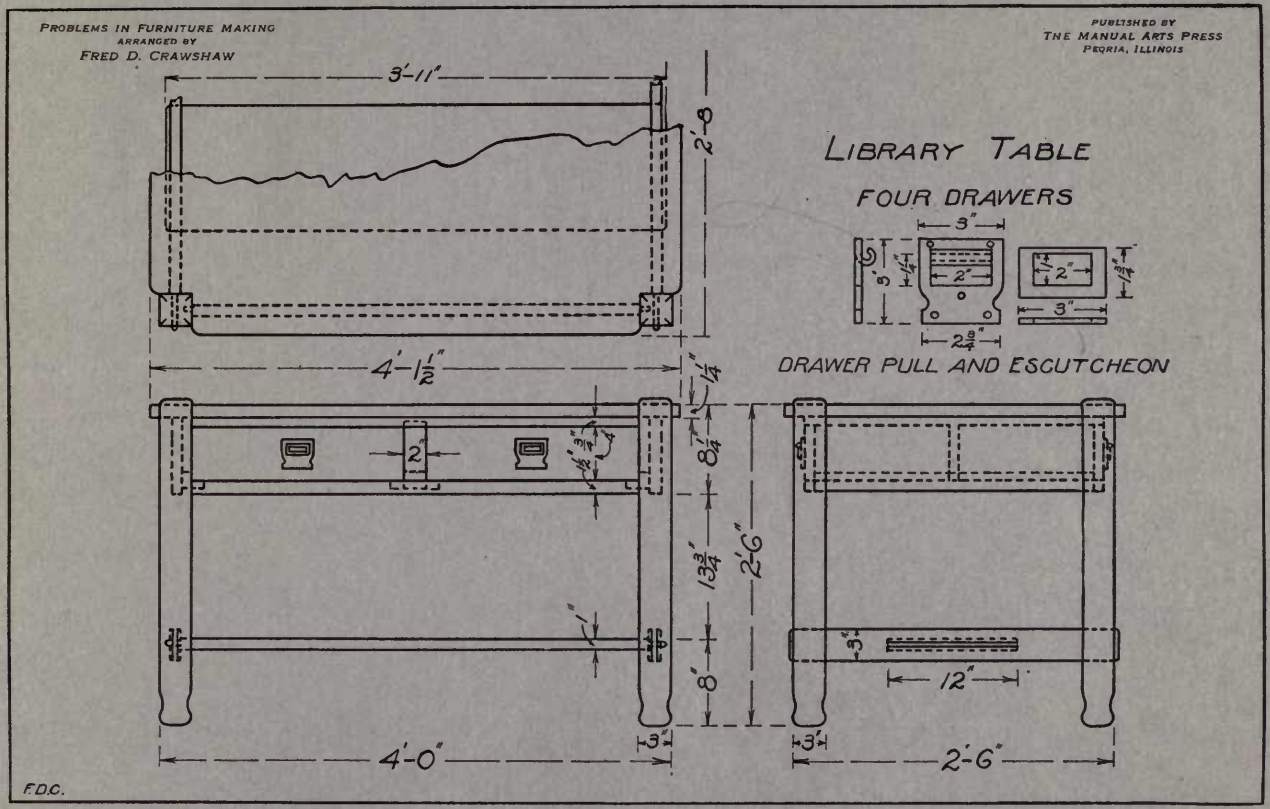
LIBRARY TABLE
WITH END SHELVES

DRAW SLIDES BOTH WAYS



F.D.G.

PLATE 39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LIBRARY TABLE
FOUR DRAWERS
DRAWER PULL AND ESCUTCHEON
3'-11"
2'-8"
4'-1½"
¼"
8¼"
13¾"
2'-6"
8"
1"
4'-0"
2'-6"
12"
F.D.C.

PLATE 40

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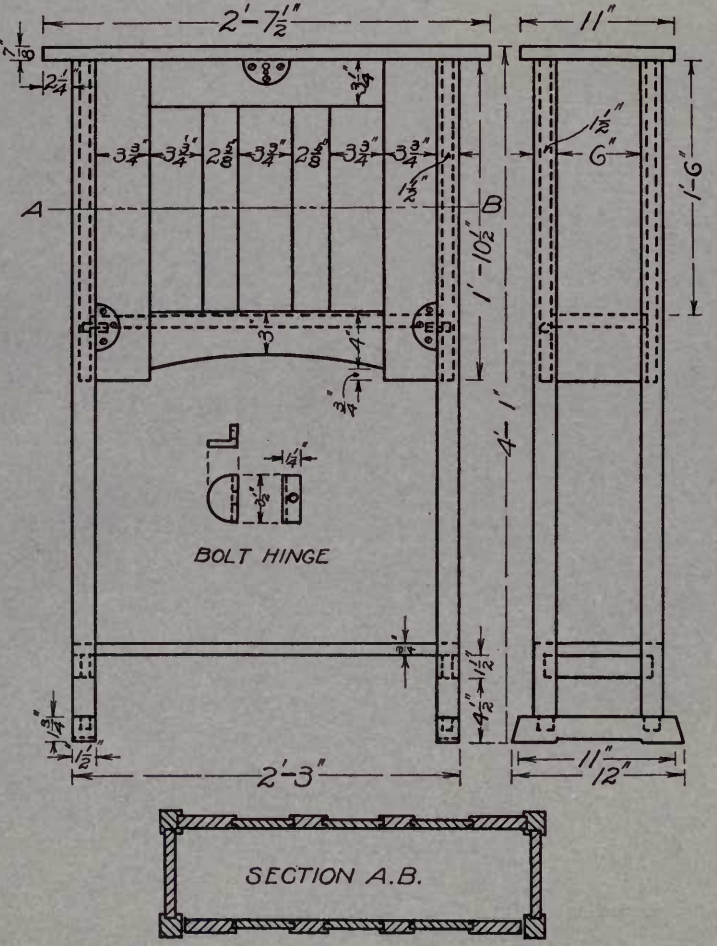
WRITING DESK



CRAFTSMAN PATTERN

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WRITING DESK INTERIOR

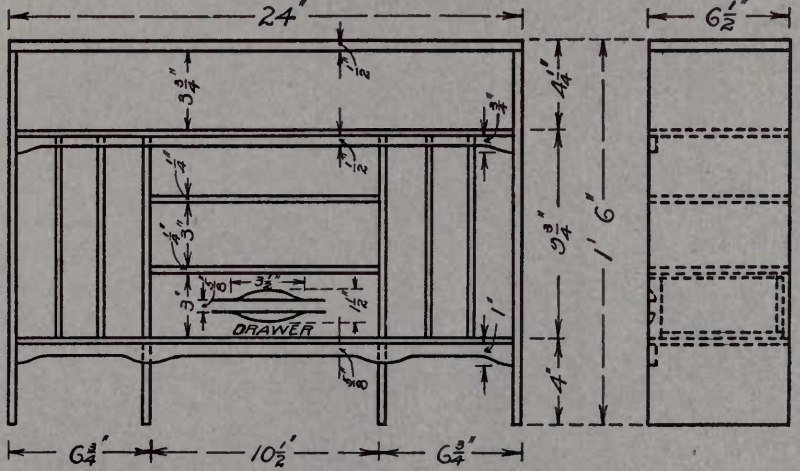

PLATE 41A

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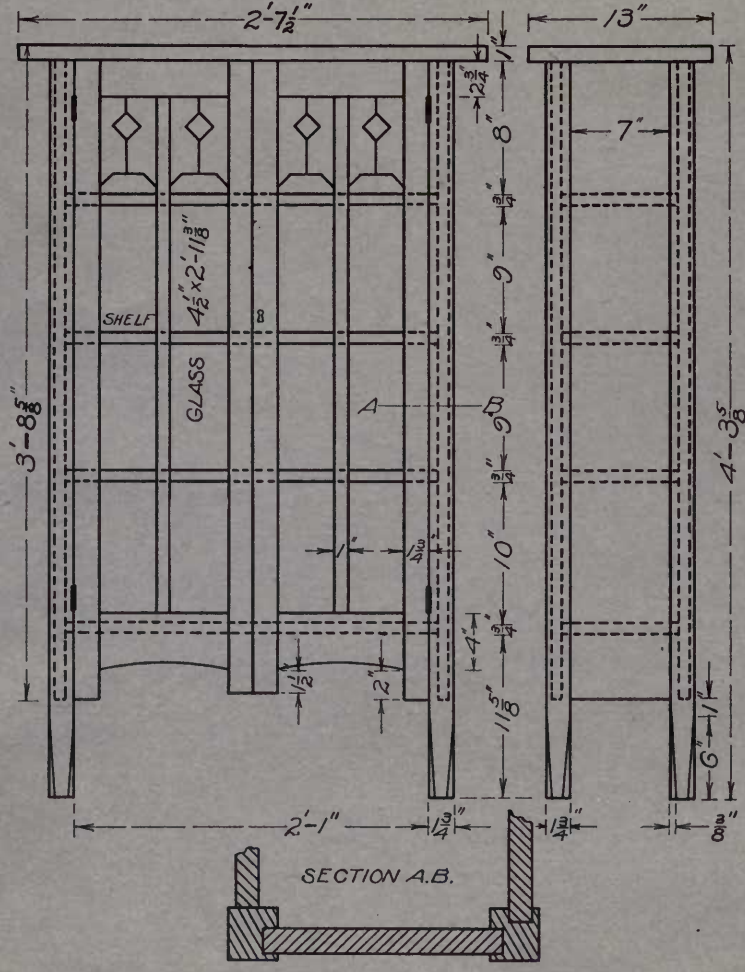
BOOK CASE



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